SCIENTIFIC AMERICAN

MAY 3, 1913

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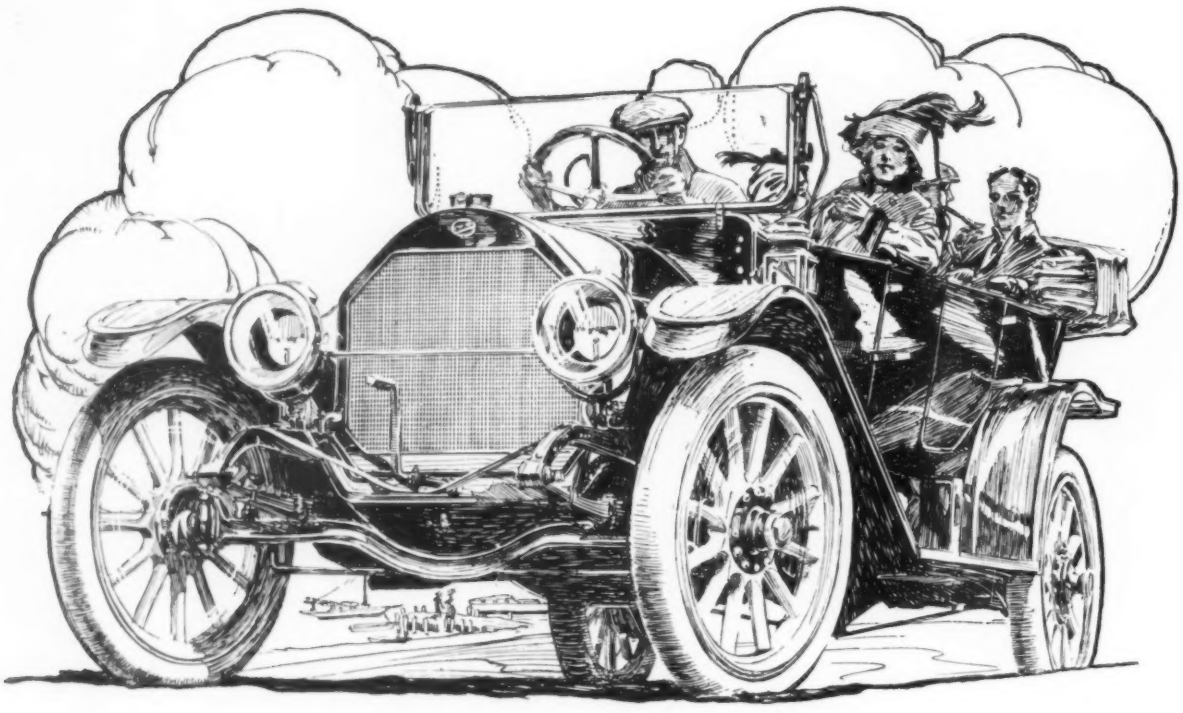
From a Painting by Gerrit A. Beneker

Safety in Travel - The Automatic Stop.
Controlling the Mississippi Flood.
Improvements in Flying Boats.

Vol. CVIII. No. 18 Munn & Co., Inc., Publishers New York, N.Y. **Price 15 Cents**



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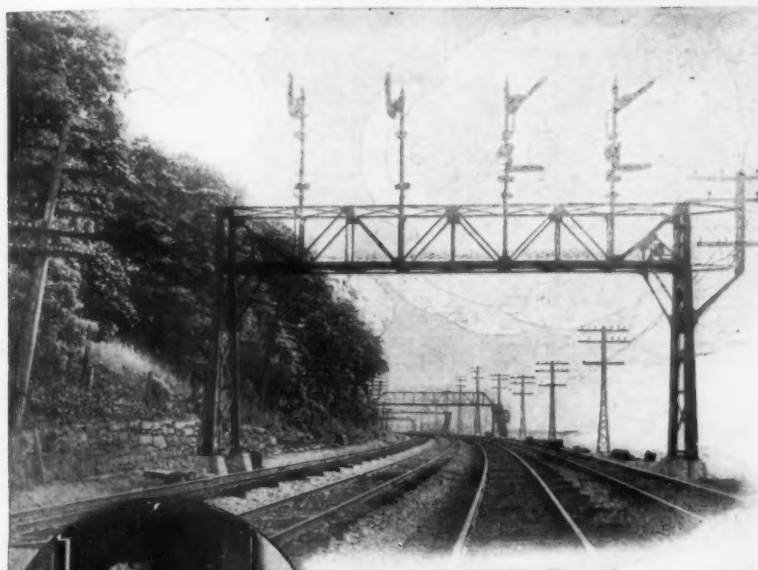

Engineer Lewis C. Henry, of the Pennsylvania Railroad's "Broadway Limited." He is one of the many fast-train engineers who carry Hamilton Watches and have carried them for years.

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"The Railroad Timekeeper of America"

is carried by *over one-half* (56%) of the railroad men on American railroads where Official Time Inspection is maintained, it is only fair to assert that the Hamilton Watch has played no small nor uncertain part in ridding travel of one of its greatest dangers—danger arising from inaccuracy of time.

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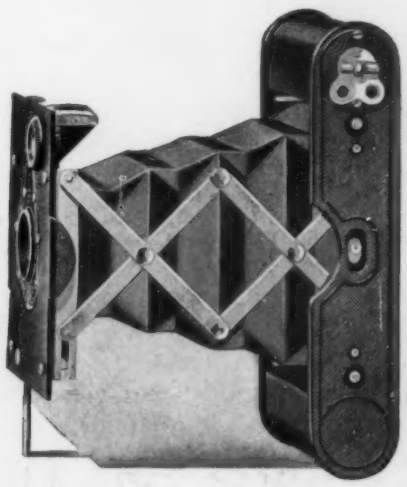

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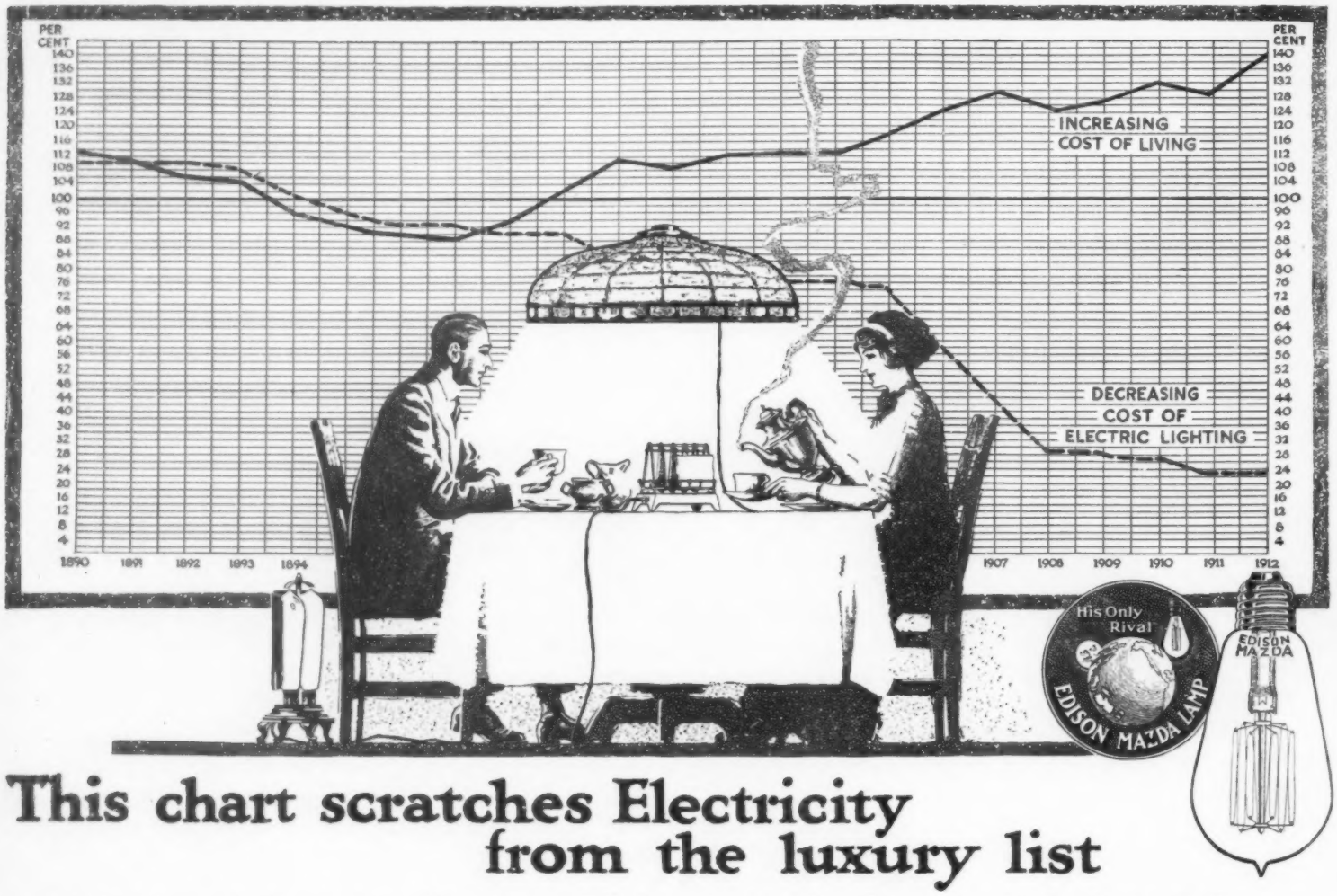
PER CENT
INCREASING COST OF LIVING
DECREASING COST OF ELECTRIC LIGHTING
1890 1891 1892 1893 1894 1907 1908 1909 1910 1911 1912
His Only Rival
EDISON MAZDA LAMP
EDISON MAZDA

This chart scratches Electricity from the luxury list

Electricity and electrical comforts—once called a luxury—are becoming a necessity in the average home.

And while the climbing cost of other necessities is putting them in the luxury class, the falling cost of electric lighting is making it easier and easier for us all to afford it.

Look at the Chart—it is based on Government figures.

Twenty-five years ago, electric light cost ten times as much as it does today. Seven years ago it cost three times as much as it does today.

All this has been effected by the progress and inventiveness of electrical manufacturers and by the enterprise and improved service of electric lighting companies.

One thing alone—the development of the tungsten filament as used in EDISON MAZDA LAMPS—has subtracted *two-thirds* from the former cost of electric lighting. Still another economy is effected by Holophane Reflectors, which *avoid waste* of light by scientifically directing it to where it will be most *useful*.

Edison Mazda Lamps give you *three times* as much light as old-style carbon lamps from the same amount of current. Put them in your home and you can have as much light—and even *more*—than old-style carbon lamps give you and *still* save enough current to operate some of the delightfully convenient electric devices shown below.

The Guarantee of Excellence on Goods Electrical

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Sales Offices in all Large Cities **The largest Electrical Manufacturer in the world** Agencies Everywhere

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By keeping its edges and entire bottom hot, the G-E Flatiron saves time and money. $4.25.

3968

For chilly mornings and cool evenings, the G-E Twin Glower Radiator. $6.00.

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The G-E Coffee Pot makes delicious coffee for less than ¼ cent per cup. $10.00

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

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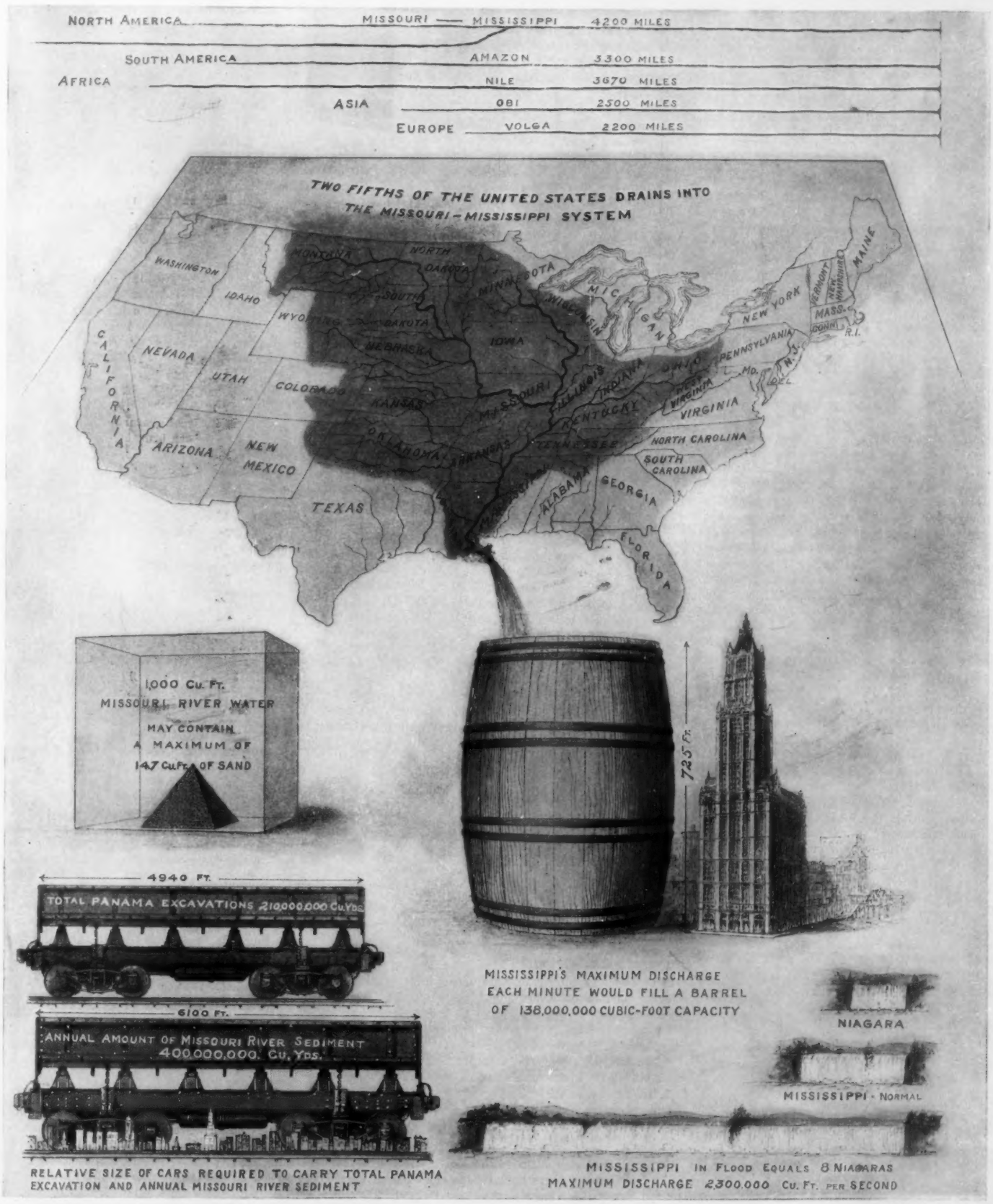
NORTH AMERICA MISSOURI — MISSISSIPPI 4200 MILES
SOUTH AMERICA AMAZON 3300 MILES
AFRICA NILE 3670 MILES
ASIA OBI 2500 MILES
EUROPE VOLGA 2200 MILES
TWO FIFTHS OF THE UNITED STATES DRAINS INTO THE MISSOURI-MISSISSIPPI SYSTEM
1,000 Cu. Ft. MISSOURI RIVER WATER MAY CONTAIN A MAXIMUM OF 1.47 Cu.Ft. OF SAND
4940 Ft.
TOTAL PANAMA EXCAVATIONS 210,000,000 Cu.Yds.
6100 Ft.
ANNUAL AMOUNT OF MISSOURI RIVER SEDIMENT 400,000,000 Cu. Yds.
RELATIVE SIZE OF CARS REQUIRED TO CARRY TOTAL PANAMA EXCAVATION AND ANNUAL MISSOURI RIVER SEDIMENT
725 Ft.
MISSISSIPPI'S MAXIMUM DISCHARGE EACH MINUTE WOULD FILL A BARREL OF 138,000,000 CUBIC-FOOT CAPACITY
NIAGARA
MISSISSIPPI - NORMAL
MISSISSIPPI IN FLOOD EQUALS 8 NIAGARAS MAXIMUM DISCHARGE 2,300,000 Cu. Ft. PER SECOND

THE INTRACTABLE MISSOURI-MISSISSIPPI SYSTEM.—[See page 396.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Human Factor in Safe Transportation

NOTWITHSTANDING the many excellent devices that are being provided to secure safety on American railways and the improved conditions of maintenance of track and roadbed, as well as the gradual extension of block signals and other protective appliances, there seems to be a very marked increase in the number of railway accidents as years go on. In part this can be explained. New conditions of operation, such as increased speeds and weights, present new problems, and in many cases an attempt is being made to carry on such traffic over tracks where rails and roadway are not always adequate.

But there is one important respect in which there has been little progress, namely, the responsibility of the individual employee. To-day it is the human factor that is most engrossing in any discussion of safety on American railway lines. The deficiencies of the human being, and especially direct personal responsibility, have been established in many collisions and derailments, and in numberless minor accidents. This has been realized by operating officials. By them the question is often considered one of discipline only, in which their efforts have been weakened by the interference of labor organizations and controversies that seemed merely questions of discipline. But it is now realized that by stimulating individual interest and responsibility on the part of the employees, railway operation can be made safer and traffic can be carried on by the companies themselves more economically and expeditiously.

Indeed, the matter has a distinct economic bearing. Payments made on account of injuries to persons during 1911 aggregated $25,979,747, or 0.946 per cent of the gross earnings for that year, and for loss and damage to property $33,978,746, or 1.238 per cent of the gross earnings, making a grand total of nearly $60,000,000, or 2.19 per cent of the gross earnings. This stands for gross waste and economic inefficiency, and the further investigation is made along these lines the more is this apparent. With or without costly damage suits the railway may in part compensate the sufferers, or by accident insurance or benefit associations the burden may be distributed. In the end it is the public that pays either in diminished earnings and dividends, increased transportation charges, or increased premiums or assessments. Furthermore, to the railway itself the loss of life of a capable employee is at least a temporary dislocation of the machinery of transportation, requiring readjustment that may involve more or less time and expense. As in other industries skilled railway employees are no less an asset than material equipment, and they should be conserved with even greater care.

The problem of safety resolves itself into the training of efficient employees and their conservation when once trained. Toward realizing this end there has been, within a few years, a distinct tendency toward improvement manifested by a spirit of co-operation between operating officials and employees, and a study by the latter of conditions that will secure greater safety.

It has been brought to the attention of the employees with blunt force that they, rather than the presidents, superintendents and other officials, were the ones to suffer in accidents; that while stockholders might pay, it was the men who were killed and their families who were left in straitened circumstances; that the railroads formulated rules and operating conditions to be observed, and that under no circumstances whatever for real or fancied advantage to the company did they desire any chances taken that might cause the slightest possible mishap. It was shown to the railway employees that most of the accidents on railroads were due to their carelessness, disobedience of orders or rules, and negligence.

For example, such trivial matters as projecting nails on platforms, or more particularly on broken cleats from freight cars thrown along the track, are annually responsible for a large number of serious injuries to railway men, and the slightest amount of caution in this respect would save many thousands of dollars' loss in wages, not to mention suffering and serious injury. Again, failure properly to pile ties, lumber and other material, to close gates, to remove objects in train yards over which a freight brakeman might stumble in the dark, to illuminate the interior of engine houses properly, and the lack of observance of a thousand other points of good house-keeping and maintenance, are responsible for a list of casualties that is striking in its aggregate. But such misfortunes it may be urged are small and bear little relation to the large wrecks in which a score of passengers may be killed or injured. The same condition holds in the direct problems of operation. The trainman may not take the trouble to go back far enough to protect the rear end of his train; the engineer may think he can make time by taking track he is not entitled to; the track foreman may consider a certain section of line with imperfect ties or poor surfacing will answer, while maintenance-of-way officials may consider short cross-overs safe, though realizing the speed of the regulation will be exceeded in passing them. In other words, if the employee is urged to see and remove the projecting nail on the platform, increased safety for him and his fellows is provided; if the brakeman will go back sufficiently to protect the rear end, whether it means a longer walk or delay of the train, until the engineer whistles to call him back, the lives of passengers and employees alike are safeguarded; if the track master will avoid unsafe cross-overs at speeds which he knows will be used, there will be a corresponding gain in the safety of the system.

Obviously this is more than a matter of discipline. If the personal interest of each employee can be aroused, then a great step forward is taken. That this can be done and has been done is shown by the improved record of a number of roads where so-called safety committee organizations have been established. These safety committees are formed of representatives of each class of operatives and certain operating officials. They carry on a campaign of education and inspection, calling attention to the rules and insisting on their strict obedience, urging the employees to report any and all conditions that are in any way dangerous, and to suggest means for safer and better operation. They also urge the employees to eliminate from the service those whose conduct is likely to produce loss of life or injury to their fellow-workmen. Such safety committees are now organized on lines representing over half of the entire mileage in the United States, and they have received the most enthusiastic commendation of the railway authorities, as well as of the Interstate Commerce Commission.

Another Mad Patent Bill

EXCEPT the tariff and the currency, no subject seems so attractive to the legislative tinker as that of patents. The latest bill which seeks to improve our patent system springs from the fertile brain of Mr. Stephens of Texas. Its object is to require citizens of foreign countries who may apply for copyright registration or for letters patent in the United States to pay the same fees and to be subject here to the patent and copyright laws and regulations of their own government.

Apparently the practice of law is not complicated enough for Mr. Stephens. He would require patent lawyers to follow not only the intricacies of our own statutes, but to acquire an intimate knowledge of all foreign patent practice as well. The judges of our federal courts would have to interpret foreign patent laws and to apply them in this country, although they have difficulty enough in interpreting and applying our own. The Patent Office would be required to keep an elaborate set of books in order to collect taxes and to enforce other burdensome regulations.

Fortunately this spring madness is not likely to be taken very seriously. Inventors have reason to be thankful that tariff reform is just now engrossing legislative attention.

Solving New York's Pier Problem With the Model Basin and the Moving Picture

THE pier problem of the North River has vexed for some years both the municipal dock experts and the army engineers. Both bodies have taken opposite views as to the propriety and wisdom of lengthening the berthing spaces for great transatlantic express steamers. New York had hardly more than finished a group of splendid piers ere the fact was discovered that none of them was long enough for the "Olympic" or for her sister ship, which was to follow, the "Titanic." When promised that piers of fitting dimensions would be built elsewhere on the river, the Secretary of War granted permission for the temporary extension of two of the new docks in the Chelsea section facing Castle Point, on the New Jersey shore.

Since then, the dock authorities of the port and other municipal heads have not agreed where the promised piers should be built, and the time allowed by the Secretary of War for the continuance of the temporary extensions referred to has about come to an end. What has appeared to be a critical stage in the situation has recently been relieved by the announcement that the city of New York is now ready to start work on new piers. With that understanding, the War Department has permitted the temporary extensions to remain a while longer.

The present Chelsea piers bound on one side the narrowest section of the North River, and tidal conditions have been radically changed there in the course of the last few decades by encroachments which have tended greatly to increase the force of the currents. The dock authorities of New York have held that the 100-foot temporary extensions to two of the piers could be maintained without adding to the difficulties of river traffic. The army engineers have maintained otherwise. At this stage of the controversy the Chief of Engineers of the United States Army turned the puzzle over to Naval Constructor D. W. Taylor, U. S. N.

That distinguished authority looked upon the problem largely as a development of the phenomena of suction between ships, and he arranged the basin to represent on a reduced scale the flanking shores of the river with piers of suitable proportions. He sought to determine the suctional influence of a great liner approaching and leaving her dock, both upon river traffic and upon other vessels lying at their piers. In order to make records of all of the disturbing influences created by express steamers ranging in size up to a thousand feet in length, moving picture cameras were employed to catch every movement. Data have been obtained of the utmost value, and the problem of further extending the Chelsea docks has been thus disposed of. What would have continued to be a subject of discussion has been helpfully and suggestively settled at a very moderate cost.

Apart from its local character, the manner in which this question has been brought to a focus and analyzed through the medium of the model basin has a nation-wide significance. Encroachments upon the tidal basins of many of our ports and the immediate demands of commerce have caused "improvements" to be made, which, later on, may lead to troublesome conditions, just as current velocities in some parts of New York harbor to-day are eighty-odd per cent greater than they were years ago. These changes add to the difficulties of river traffic and the cost of all towing that must be done against the sweep of the tide. Piers, of course, of suitable proportions must be built for ocean liners as they grow, but they should be placed where they are least likely to disturb the regimen of the stream seriously. When these questions arise hereafter the model basin will be able to guide us more intelligently and will safeguard us against mistakes which may hamper harbor shipping in the years to come.

Reliability Requirements and the Cost of Electric Power

MANY factors enter into the economics of electric power production. For the best economy it is, of course, desirable that the load be distributed as evenly as possible over the twenty-four hours of the day. Hence the low charges for electrical energy during the daylight hours, in plants whose main output is spent for lighting purposes. But there are other factors whose influence is more difficult to gage in actual figures. Thus Dr. Steinmetz points out that the cost of power depends among other things upon the requirement of reliability and continuity of service, a requirement which varies greatly in importance from case to case.

A breakdown, even of a few moments, in the electric power plant which supplies a large city with current for lighting, running elevators and so forth, will not only cause great inconvenience and annoyance, but may, in a crowded theater for example, bring panic and disaster in its train. The case is somewhat different as regards the power supply to factories, railways and similar institutions. Here a few minutes' breakdown is no doubt a cause of loss, but not comparable in its results with a failure extending over twenty-four hours, say. Then again, in certain cases a shut-down of even a fraction of a minute may mean great loss. If the current is cut off the furnace in certain electrochemical operations, even for a quarter of a minute, the whole charge may be lost, and the furnace itself may be destroyed.

Where such guarantee of reliability is required, naturally the cost incurred in providing for it must enter into the price of power, a fact which is not always appreciated by the layman.

Engineering

Gustav Wilhelm Wolff, founder of the shipbuilding firm of Harland & Wolff, Belfast, died on the 17th of April at the age of 79. His firm opened its yards in 1860. Mr. Wolff designed the original White Star ships. The "Titanic" and the "Oceanic" were built by this firm.

The Iceberg Patrol.—In conjunction with the British steamship "Scotia," the revenue cutter "Seneca" is patrolling the transatlantic steamship lanes in search of icebergs and other menaces to oceanic travel. The revenue cutter carries a powerful wireless set with which it is warning approaching passenger vessels of the presence of icebergs.

The "Aquitania," the latest giant liner of the Cunard Company, was launched April 21st on the Clyde. The length of this vessel is 901 feet, breadth 97 feet, depth from keel to boat deck 92 feet 6 inches, and gross tonnage 47,000 tons. Her estimated speed is 23 knots. There will be accommodations for 3,260 passengers with a crew of nearly 1,000. A description of this vessel appeared in the SCIENTIFIC AMERICAN SUPPLEMENT of April 26th.

Progress on the Panama Canal.—On April 1st there remained only about eight thousand linear feet of the Culebra cut that had not yet reached grade in some parts. At the present rate of progress it is estimated that 5,500,000 cubic yards of material may be removed by October 1st. Work with steam shovels will then cease and dredges will be used to remove the two or three million cubic yards remaining. This amount will no doubt be increased by slides. A record for steam-shovel output was made on March 29th, when five steam shovels removed 11,343 cubic yards of material in a single day from the Cucaracha slide.

Unusual Type of Diesel Engine.—Probably bringing the true Diesel engine for self-propelled road vehicles at least one step nearer, J. Bukh, a Danish inventor, has developed an engine of that type in which the compression is variable and which dispenses with the usual compressed air starting apparatus. In Bukh's engine, there is an auxiliary combustion chamber in the cylinder head controlled by a valve. When starting, the valve is opened, thus lowering the compression to approximately that of the ordinary internal-combustion engine, and after the engine has taken up its cycle of operations the valve is closed, when the engine then operates on the Diesel principle.

Italy to Promote Agricultural Tractor Competition.—Now that so much attention is being given motor-propelled farm apparatus, additional interest centers in a competition for agricultural tractors which is to be promoted by the Italian Touring Club, the Italian Federation of Agricultural Associations and other prominent bodies. The Italian Touring Club is the moving spirit in the venture and is located at Via Monte Napoleone, Italy. The events will take place at Parma and will include an international field competition of motor apparatus for the cultivation of land, a national competition for internal-combustion motors and an international competition for internal-combustion crude oil agricultural engines. Entries should be addressed to the Italian Touring Club.

Rotterdam's New Harbor, which is rapidly nearing completion, will be the largest artificial harbor in the world, the water having covered 766 acres. It was in 1907 that the municipality voted its construction, and work was at once commenced on those portions lying without or beyond the Maas dyke. As for the polder land within the dykes, a law of expropriation had to be passed. As soon as that was passed—in 1911—work could be commenced there as well. Meanwhile in the outer dyke portion a basin of 125 acres, of which 106 acres is 28 feet deep, was completed and at once taken into use. Indeed, as early as 1908 the first sea-steamer moored there. So, as soon as the expropriation had taken place, work was commenced on the portion within or behind the dyke. This proceeded but slowly at first, for it had to be done "on the dry," as they say there, by excavation, which can only remove a maximum of 45,000 cubic yards in a week (while dredging machines can in the same time remove 85,000 cubic yards). But there was no other way, for if the water had been let in by piercing the dyke, all the low-lying land behind it would have been flooded, so the portion of the polder destined for the harbor, some 230 acres, had first to be inclosed by a dyke that joined to the existing Maas dyke at each end. This new dyke is 16 feet high and about 7,900 feet long. Behind it is a raised roadway 33 feet wide, where a railway is planned to run right along the harbor. About 1,400,000 cubic yards of earth went toward constructing the dyke and road, the earth being excavated from the harbor. The last excavator stopped work in October last and a dredging machine was at once set to work to dredge away the portion of the Maas dyke that still separated the outer from the inner portion, thus letting the water into the new basin. Since then work has proceeded rapidly. When completed the harbor will have a depth of 28 feet.

Science

An Anti-earthquake Construction Exposition will probably be held at Messina, Italy, in the autumn of 1913, in conjunction with the sessions of the Congress of Civil Engineers.

Amundsen Financed by Americans.—The National Geographic Society has granted $20,000 in cash to Capt. Roald Amundsen for his coming expedition to the Arctic regions. Thus the financial success of the project is assured. The Norwegian Geographic Society has offered to raise $40,000.

The Upper Irawadi.—A British expedition, under official auspices, is now engaged in the difficult and dangerous task of exploring the little-known territory about the head-waters of the Irawadi, the great river of Burma. The expedition consists of two parties, one under Mr. J. Barnard, and one under Mr. F. V. Clerk, and will be in the field for about 5 months.

Wood Sugar.—The making of grain or ethyl alcohol from sawdust has been so restricted in England by absurd regulations that the industry is seriously crippled. Classen's process made use of the fact that sawdust digested with a weak solution of sulphurous acid under six or seven atmospheres pressure is converted into sugars with a yield of about twenty-five per cent. Four fifths of this can be fermented into alcohol if desired, but now the English are extracting this crude wood sugar and using it as stock food. It cannot be crystalized for commercial table use.

Dried Potatoes as Cattle Food.—Germany is evolving an ever-increasing number of potato products and thus rapidly solving the problem of disposing of the once enormous surplus of this crop. A number of establishments in that country are now turning out quantities of dried potatoes, in various forms, for use in feeding cattle. According to a recent consular report, dried potatoes do not cause the forms of sickness that result from a diet of raw potatoes. Moreover, raw potatoes can be preserved for only a limited time, while to boil the potatoes would impose upon the stock-raiser more expense than the circumstances justify. Official tests have proved that the one third of strengthening food generally given to horses in the form of grain could be replaced by dried potatoes, and such animals would be kept in excellent condition.

Diselectrifying Silk by Radium Salts.—During the process of combing silk the skeins become highly electrified, and it has been the habit to remedy this condition by maintaining a damp atmosphere in the workroom. This is, however, prejudicial to the health of the workers, and may be avoided, according to a writer in *Cosmos*, by the very simple expedient of placing near each loom a receptacle containing a weak solution of a radium salt. The electric charges issuing from the radium neutralize the electrostatic charge which the threads of silk acquire by reason of friction. A similar problem in the manufacture of linen has been solved somewhat differently by MM. Paillet, Ducretet and Roger. To diselectrify linen during the spinning process, or the stretching of the threads, they employ the sparks of high-frequency currents, which are, as is well known, non-injurious to the human body.

Disinfecting Linen.—In cases of measles, scarlet fever, and other infectious diseases it is highly important that the linen used by the patient should be disinfected at once, especially when the laundry work is done outside the home, as is usual in most modern cities. Otherwise it may become a source of danger to the persons handling it, or may infect the hampers in which it is stored or carried. *Les Annales* suggests two or three simple but effective methods to accomplish this purpose. One of the best is to moisten with a weak solution of copper sulphate, the "one twentieth." This sterilizes without injuring, and the faint blue tinge left is removed by washing. Calcium chloride is likewise effective, but it smells strongly of chlorine, which is often objectionable. In the Pasteur Hospital a 2 per cent solution of cresylene is employed to sprinkle the objects. This completely sterilizes in 24 hours.

Welded Aluminium Joints.—A German inventor, Otto Nicolai of Bonn, claims to have found an excellent method for detecting the soundness of welded joints in aluminium wire or manufactured articles, especially vessels and the like. To see whether the joint is in good condition, all that is needed is to put it in water, and if bubbles of gas are seen within the space of forty-eight hours, this is a sign that the welding was badly done, and in such case the sample will be sure to break down sooner or later. The gas given off here is hydrogen. He claims that a bad joint will give out by a 14 days' immersion in water, as the metal disaggregates, while in the air the time is considerably longer, six months or more before breaking down. Damp air causes the failure to take place in less time, as may be expected. For domestic utensils there is great danger of the aluminiums wearing off and taking the shape of cutting scales of metal, and when these enter the digestive organs they are likely to do much damage.

Aeronautics

A New Balloon Duration Record.—On March 23rd, Rene Rumpelmayer made a long distance flight in a free balloon from Paris to a point near Kharkov, Russia. He traveled a distance of 2,400 kilometers (about 1,492 miles). Rumpelmayer was pilot of the balloon "Picardie," which won the last Gordon-Bennett race. In that race he made a record of about 1,361 miles.

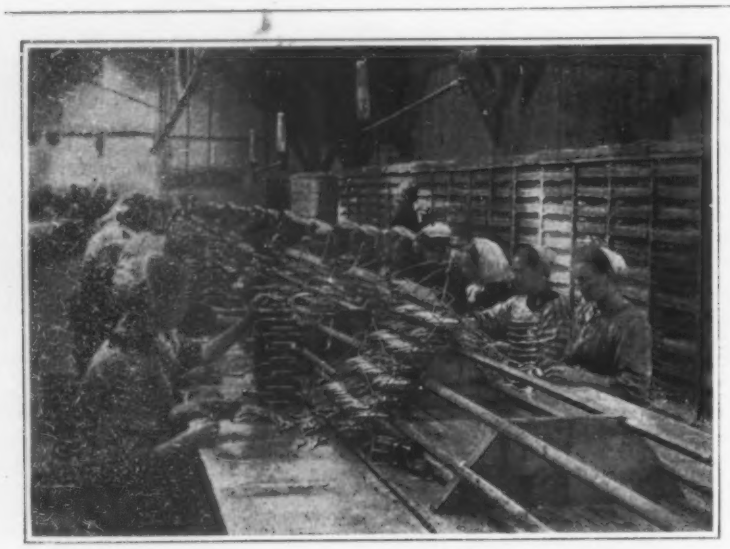
A Flight from Dover to Cologne with a Passenger.—On the 17th ult. Gustav Hamel made a record flight with a passenger from Dover, England, to Cologne, Germany—a distance of 245 miles—in 258 minutes. Five countries were flown over and five showers were encountered besides a hailstorm which was met in mid-channel and successfully flown through. This was the twelfth crossing of the Channel by Hamel, who uses a Blériot monoplane. The flight demonstrated the immense value of the aeroplane in traveling quickly from country to country without let or hindrance.

Life Saving Device for Aeroplanes.—Joseph M. Connor of New York and Elmer R. Conner of Port Richmond, N. Y., in a patent, No. 1,057,221, provide for combining with an aeroplane a parachute and a harness which secures the parachute while folded directly to the body of the aeronaut. There is an independent belt adapted for attachment to the body, and cords connect the belt and parachute and there is a cord which directly connects the peak of the parachute and the aeroplane. This cord operates first to position the parachute over the body, should the body fall, and to break after the weight of the body is placed upon the parachute and after the parachute has been positioned over the body.

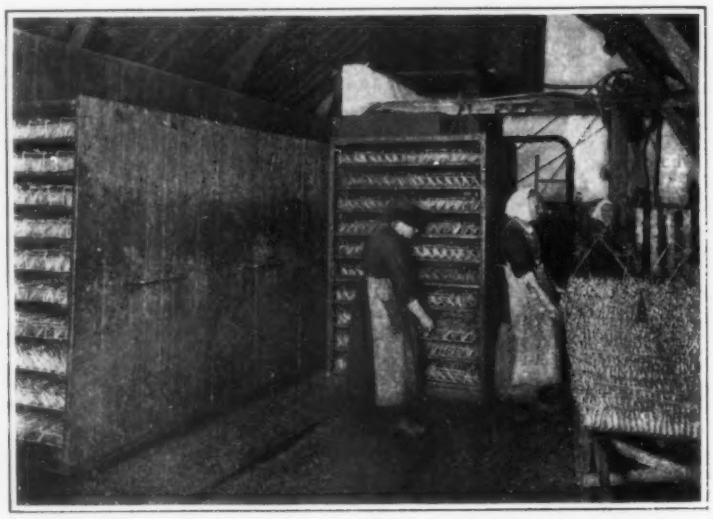
Flying in Winter.—The severe cold which prevails in Russia and the resulting atmospheric conditions make aeroplane flights somewhat out of the ordinary in that country. In spite of the hard weather, the Imperial Aero Club is turning out many very good pilots at its Aeronautic School which has large aerodrome grounds devoted to this purpose in the neighborhood of St. Petersburg. We may mention a flight made by Capt. Yatsouk, the chief of the school, not long since. Along with Lieut. Golostov, he flew as far as Schuvalovo in Finland and back without alighting. At the aerodrome there are often very hard snowstorms, but the pilots still keep up their flights, even though they are much shaken up and also blinded by the snow which covers them entirely. The motor needs to be looked after constantly, as the oil thickens up in the great cold. This appears to be the first time in Europe that aeroplane flights have been made in such great cold, so that the fact deserves mentioning, and is another proof that the aeroplane will stand nearly all weathers.

A New Height Record.—A month and a half ago, a new height record of 6,000 meters was made by M. Perreyon, chief pilot of the Blériot school, with a Blériot monoplane fitted with a 160 horse-power Gnome motor. Rising from the aviation field at Buc at 11:25 A. M., Perreyon rounded the field in great circles, steadily rising until he had reached a height of 5,700 meters (18,700 feet), after which he flew in a nearly straight line in his endeavor to reach a still greater height. After an ascent lasting about an hour, he finally reached 6,000 meters (19,685 feet). The air was so clear that he could see as far as Rouen, a distance of 75 miles, and he was also visible from the ground throughout the whole of his flight. The 100 liters of oxygen which he carried gave out, and so he was obliged to descend at once. He reached the ground in 12 minutes from this tremendous height. He was not troubled with dizziness, as he inhaled oxygen—a thing which none of the other aviators have done who have flown to such a great height. The former record of 5,610 meters (18,405 feet), made by Garros in Tunis on December 11th last, was beaten by a wide margin.

Successful Test of the Gyroscopic Control for Aeroplanes.—On March 23rd, at San Diego, Cal., Lieutenant Harold Geiger and Lawrence Sperry, son of the inventor of the gyroscopic compass and of the gyroscope for stabilizing ships, both of which inventions are at present being widely used in our navy, made a preliminary test flight of thirty-five minutes duration in a Curtiss flying boat equipped with Mr. Elmer A. Sperry's new gyroscopic control for aeroplanes. The flight was successful in every way. Experiments are still being continued, and the final test is to be a deliberate attempt to upset the machine while flying over the bay. This will be a Government test, and if it is carried out successfully, the Sperry gyroscopic control will probably be fitted to all Government aeroplanes. We have already noted in these columns that this control consists of a small gyroscope weighing but 2¼ pounds, which operates the warping by means of a compressed air motor the valves of which the gyroscope controls. We understand that Count Zeppelin, in Germany, has also just brought out a successful gyroscopic control for aeroplanes, and applied it to a monoplane of his invention. In this case two large gyroscopes are used to operate the ailerons and the elevator.



Women beheading the sardines and packing them in boxes.



Sardines in racks mounted on carriages in the drying room.

The French Sardine Industry

By Jacques Boyer

WHEN you purchase a box of sardines, or when you open it and devour its savory contents, do you ever think how many hands it passed through before it reached yours? The little silvery fishes have been subjected to a long series of operations by the fishermen who extricated them from the meshes of their nets, the women who cleaned them, cooked them and immersed them in a bath of oil, the tinsmiths who sealed the boxes, and a supplementary host of packers, carriers and wholesale and retail dealers.

When the fishing boats arrive at their home port the sardines are taken to the factory, where they are beheaded, disemboweled and thrown into vats of brine, in which they remain from 15 to 45 minutes, according to their size. On their removal from the brine they are laid on grids, which in fine weather are carried to an open drying yard and in bad weather are placed in racks mounted on carriages, which are placed in chambers traversed by a current of hot air.

When the sardines are dry the grids are taken to the kitchen, where they are plunged into huge vessels of boiling oil. This operation is watched by women, who take care to remove the sardines before their flesh has been heated to excess.

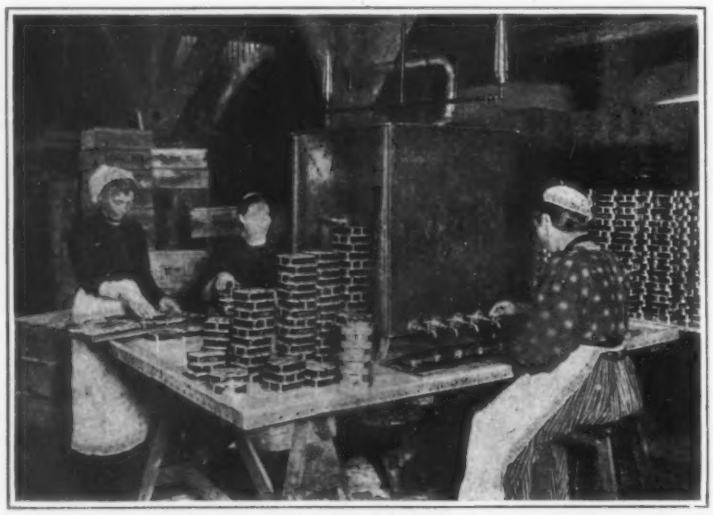
After the sardines have cooled they are deprived of their tails and packed in tin boxes by women seated at long tables. The boxes are classed as wholes, halves and quarters. The quarter box contains 8 or 10 sardines, and is the most familiar size. Sometimes pimento, sliced lemons and pickles, and other condiments are put in the bottom of the box.

The filled boxes are placed on large trays and carried to the oiling room, where the voids are quickly filled with oil flowing from a row of taps, which the operator controls with one hand, while with the other she brings each box in turn under a stream of oil.

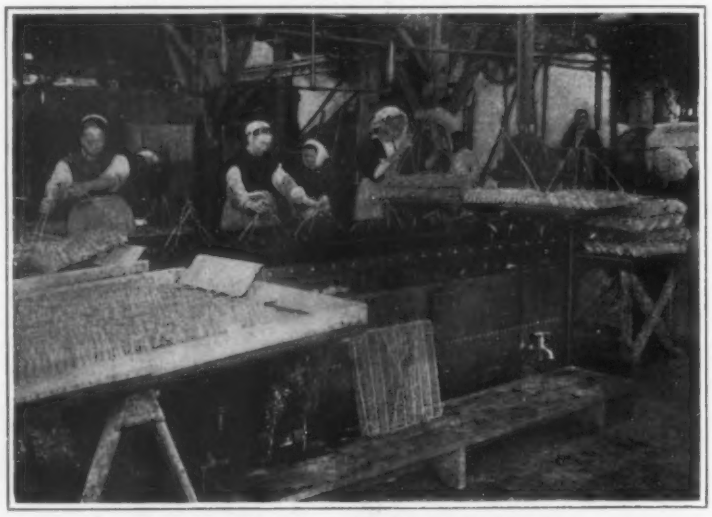
The boxes are sealed either by soldering or by folding and pinching the edges. In the former case the soldering iron is continuously heated by a blow-pipe as it passes along the edge of the box, which is clamped to a turn-table. A single blower furnishes the air blast for fifty or sixty flames, tended by as many men. In the newer factories soldering has been replaced by the more rapid and more hygienic operation of folding and pinching, which is performed by special machines so perfectly that the lid is hermetically joined to the box.

The sealed boxes are sterilized at a high temperature in autoclaves, and are then rolled in sawdust to remove oil and other impurities from their exterior.

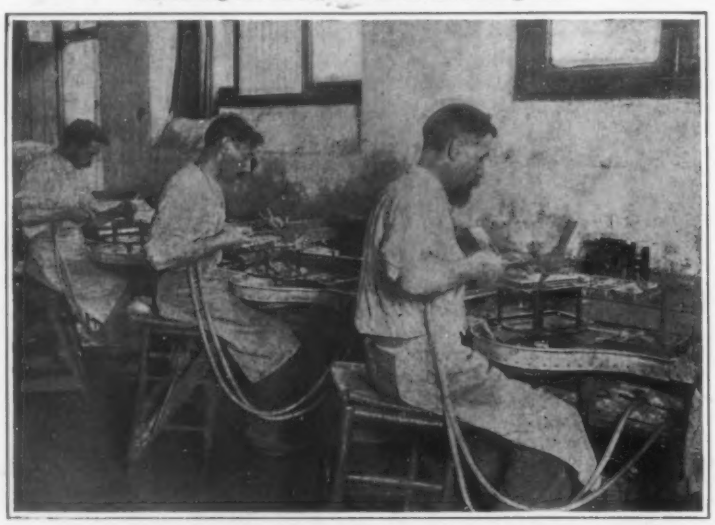
A curious and important fact in the biology of the sardine is the suddenness with which these little fishes appear in great numbers and subsequently vanish, probably in consequence of changes in oceanic conditions. According to M. Charles Rabot, sardines appear in dense schools wherever they find the most favorable degrees of temperature and salinity, and disappear as soon as the water has been replaced by a current of different character. Unfortunately we know nothing of the physical conditions which the sardine seeks, or of the movement of various strata of water along the coast. We do not know whether the sardine prefers warm or cool water, very salt or moderately salt water, nor do we know the temperature and salinity of the sea at different seasons, depths and distances from land.



Filling the boxes with oil flowing from a row of taps.



Parboiling the sardines in oil before boxing them.



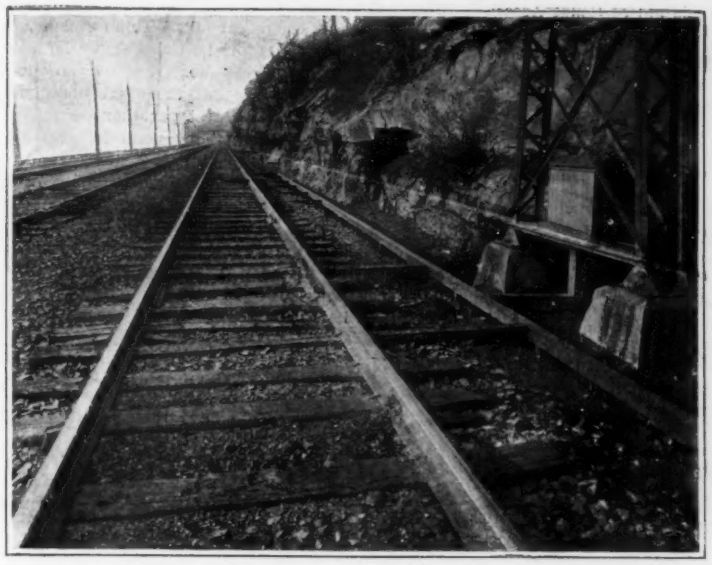
Workmen sealing sardine boxes by soldering.

In Brittany, sardines are caught with a vertical net, from 1,000 to 1,300 feet long and 26 to 33 feet deep, which is supported by corks fastened to its upper border, and is attached to the stern of the boat by a cord several yards long. As the boat moves slowly against the current the sardines are lured to the net by salted cod thrown on the water. The net is made of thread so fine that it is almost invisible and the meshes are of such dimensions that the sardines thrust their heads through them and are caught by the gills. A net raised after a few minutes' trawling sometimes yields several thousand sardines.

This simple and time-honored device gives good results in the hands of the Breton fishermen, but their rivals of the Gulf of Gascony and the Atlantic coast of Spain and Portugal prefer the circular seine, which is made by completely surrounding a whole school of fish with a vertical net and then drawing the bottom of the net together by means of a draw-string. The great bag thus formed is gradually contracted by hauling in, and the imprisoned sardines are removed by means of landing nets.

The circular seine is very effective, but its employment on the Breton coast is hardly practicable, as was proved by experiment seven years ago. The French packers, nevertheless, would like to have it adopted in order to increase the catch. Some experts recommend the Guezennec net, a floating cage of netting, open in front and on top, which is towed behind the boat and entraps the sardines as it advances. When the catch is deemed sufficient both openings are closed by drawing cords. The top is then reopened and the sardines are removed with landing nets.

The French fishermen, however, fear that an increase in the catch will lower the price, and they are reluctant to adopt any improved device, although the packers require cheap raw material in order to meet foreign competition, particularly that of Spain and Portugal, which annually throw about 1,500,000 cases of sardines upon the market. The problem, therefore, is a difficult one, and its satisfactory solution will require many concessions from both sides, before this important industry is safe from the demands of fishermen, tinsmiths and packers.



Right of way, showing joints after eighteen months wear.

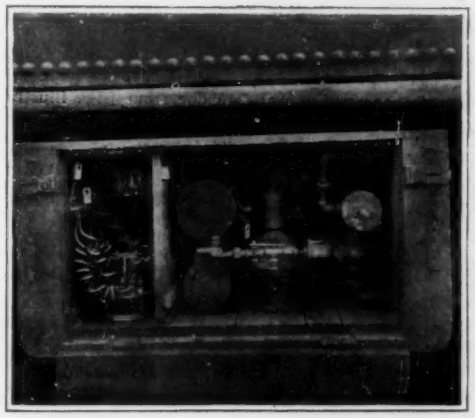
The "Cleveland Flyer" stopped by the automatic system.

A Safety Automatic Train Stop

FOR the past year there has been under test on a five mile stretch of the Pennsylvania Railroad just outside of Pittsburgh, an automatic train stop system which possesses many points of considerable interest. As pointed out in the article entitled, "A Successful Automatic Train Stop," in the SCIENTIFIC AMERICAN of January 18th last, chief among the requisites of the successful system are that it be entirely on the closed circuit principle, that it be included in the circuit of the ordinary automatic block signals and that any failure of circuits or mechanism cause it to assume the stop position. The present system conforms to all these requirements, and in addition claims as further advantages that it requires no appliances on the roadway which might be damaged by rolling stock, or that might be affected by sleet or snow, and requires no appliance on the engine which might be carried away by a projection from the roadway. Another important advantage it offers is that it can be made inoperative below certain speeds, or it will release the brakes when the speed has been reduced to a certain value, making it unnecessary to come to a full stop before proceeding. Thus the engineer is allowed to use his discretion in passing a danger signal so long as he moves slowly enough to come to a dead stop the instant the real danger presents itself to him. It is well known that block signals are sometimes thrown out of order by lightning, and any disarrangement of the system will result in the showing of danger signals. Under such conditions it is a decided advantage for the engineer to proceed, even against the signals, provided he maintains a cautious and safe pace. It is often considered desirable to have a record made of a stop in order to disclose a lapse on the part of the engineer in running past a danger signal. In the present system, such a record may be made not only of the full stop, but in case there is no stop, of the speed at which the train passed the signal. These adjuncts, however, are not shown in the accompanying drawings of the system.

The apparatus carried by the train is mounted in the tender. The locomotive is insulated from the trucks and rear coupler of the tender, so that the circuit of the train apparatus is completed through the rails. As illustrated in Fig. 1, the locomotive is indicated as *L*, the trucks of the tender at *TT*, and the rear coupler of the tender as *C*.

The apparatus comprises a low voltage battery *EB*, adapted to energize a magnet valve *MV*, operating a brake valve *BV*. In the circuit of the magnet valve is a relay valve *R*, which is energized by current coming through its own contact, so that if the circuit is once broken the relay must be re-energized through some other contact which is provided by cut-off valve *CV* or speedometer *S*. As a means of indicating whether the apparatus is under proper control, the lamp *BL* is provided on the locomotive together with the key *K*. The cut-out valve *CV* is normally held open by a spiral spring, and when open furnishes free passage for air from the train line to the brake valve *BV*, and closes contact for electric lamp *BL*. When the valve is partly closed, it closes contact for re-energizing the relay *R*. The spiral spring prevents its being left in this position. When the valve is fully closed it locks itself, breaks contact for the light *BL* and cuts off the brake valve *BV* from the train line.



Instrument box carried by the tender.

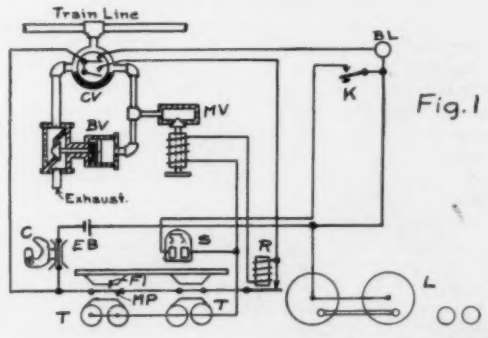


Fig. 1.—Diagram of engine apparatus in normal running condition.

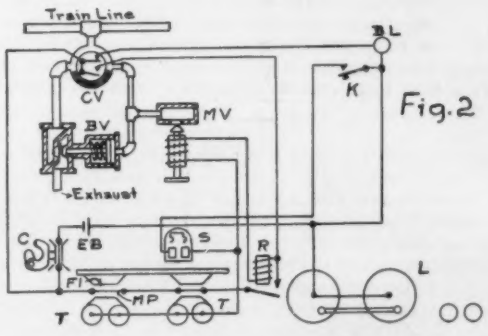


Fig. 2.—Diagram of engine apparatus when entering an occupied block.

The operation of the stop apparatus is accomplished, as will be explained below, by the introduction of a current of opposite polarity through the system, from the track, which will neutralize the energy of the relay *R*, permitting the contact point to drop and break the circuit. If desired the valve *CV* may be located in some place accessible only from the ground, making it impossible to re-energize the relay *R* until the train has come to a full stop. The speedometer *S* is provided with contacts that are closed at any speed desired so that a stop can be avoided if the speed is low, provided the engineer closes the circuit of the speedometer by depressing the key *K*. He may also use this means of releasing the brake when the speed has been sufficiently reduced.

As the operation depends on the integrity of the insulation between the tender and its truck, it is necessary to provide a leakage detector for this insulation. This is accomplished by making the insulation in two sheets *FI*, with a steel plate *MP* between. The steel plate is made a part of the circuit of the engine relay and is so placed that any leakage through the insulation will rob the relay *R* and cause it to open. Since the rail between engine and tender is part of the engine circuit any breakage in both rails at the same time will de-energize relay *R* and apply the brakes, unless some other path be provided for the engine current.

At any location such as a block signal where it is desired to control the engine, insulated joints *IJ* and *I'J'* (Fig. 3) are placed directly opposite in the track, and track apparatus is provided to make this path if the track ahead is safe, but to break the path or place in it an obstacle, if the track is unsafe.

The track apparatus at each signal consists of a track relay *G*, and insulated joints *IJ* and *I'J'* as used at present automatic block signals, a high resistance line relay *J*, a detector relay *F*, and a low voltage battery *CB*. The relay *J* is energized by the same battery *SB* used for operating the automatic signals and is controlled by track relay *G* at signal ahead. Two of the contacts of relay *J* serve as a reversing switch controlling the relation of battery *CB* to the engine battery *EB*. In order to be certain of the insulation of the insulated joints, a means of detecting a breakdown is provided in the relay *F*, which is normally de-energized and controls track relay *G* through a back contact, but if the insulation of the joints should decrease, current leaking across will energize relay *F*, and thus de-energize relay *G* and relay *J* at the signal

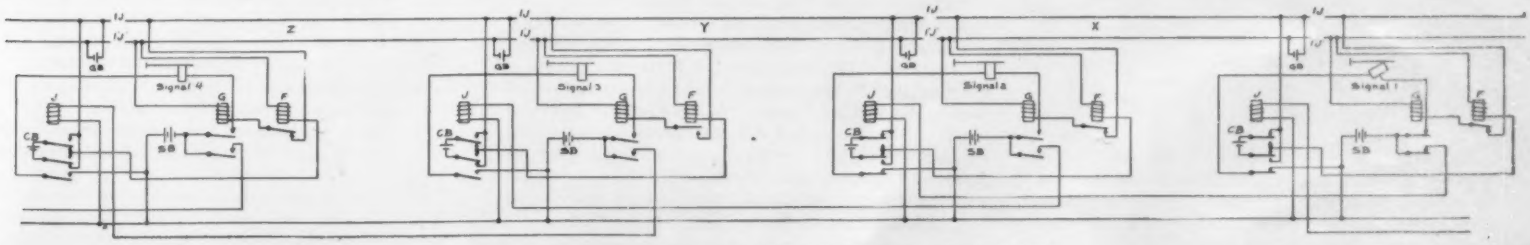


Fig. 3.—Diagram of the track circuits showing an occupied block.

in the rear. Battery *CB* is constantly in series with relay *F* across joints *IJ* and *I'J'*, so that any leakage of current will cause relay *F* to pick up and to open relay *J* at signal behind. The loop circuit through battery *CB* and relay *F*, around the insulated joints, serves not only as a detector of the joints, but also as a path around the joints for engine current in case the track ahead is safe for the passage of the train. In case the track is unsafe, relay *J* will be opened, and although battery *CB* is still connected to the rails, ready to detect the joints, its polarity is reversed in relation to engine battery *EB* so that if an engine should attempt to pass at this time, its relay *R* would be opened and the brakes applied. Battery *CB* is placed in the loop circuit in order to test its condition at the passage of every train that receives a "proceed" signal. To insure that *CB* is in good working order, the resistance of relay *F* is made so high that engine relay current cannot get through without the aid of battery *CB*.

Fig. 1 shows the engine apparatus in normal running condition, and about to pass signal 1 (Fig. 3) at "proceed." The rail between engine and tender being part of the engine circuit, as the engine is passing signal 1, while a space between the last engine wheel and first tender wheel is spanning the opposite insulated joints, the engine current must find some other path than the rail, and this path is provided through the coils of relay *F* and battery *CB* in same polarity as engine battery *EB*. Block *X* being occupied, the track relay *G* at signal 2 is open, and this of course opens relay *J* at signal 3. Relay *J* being opened, reverses the polarity of battery *CB* so that when a second engine tries to enter block *Y* as shown at Fig. 2, its engine circuit encounters a battery of opposite polarity, which instantly opens engine relay *R*, and applies brakes. After the speed has been reduced to the predetermined value so that contacts in speedometer *S* are closed, the key *K* may be used to re-energize engine relay and train may proceed.

One of the accompanying photographs shows the P. R. R. "Cleveland Flyer" brought to a stop by the automatic system. The man on the ground at the side of the tender has his hand on the valve key releasing the brakes after the engine has been automatically stopped. The relay and valves are all located in this box under the side of the tender.

An International Congress on School Hygiene

ALL the leading nations, every State in the Union, every college and university of note in this country and various other leading educational, scientific, medical and hygienic institutions and organizations, as well as various women's organizations, will be represented at the Fourth International Congress on School Hygiene, in Buffalo, August 25th to 30th, according to a preliminary statement just issued by Dr. Thomas A. Storey of the College of the City of New York, secretary-general of the congress.

Mr. Woodrow Wilson, as President of the United States, has accepted the honorary office of patron of the congress. The president of the congress is Mr. C. W. Eliot, one time president of Harvard University. The vice-presidents are Dr. William H. Welch, the great pathologist of Johns Hopkins University, formerly president of the American Medical Association, and Dr. Henry P. Walcott, president of the recent International Congress on Hygiene and Demography, and chairman of the Massachusetts State Board of Health.

It is the aim of the organizing committee in charge to bring together at Buffalo a record of men and women interested in improving the health and efficiency of school children, and to make this congress—the first of its kind ever held in America—one of direct benefit to each individual community. A programme of papers and discussions is now being arranged covering the entire field of school hygiene. There will be scientific exhibits representing the best that is being done in school hygiene, and also commercial exhibits of educational value.

Nor will the entertainment of delegates in any way be neglected. Buffalo has just subscribed $40,000 toward covering the expenses of the congress. The Buffalo citizens' committee has planned for a series of social events, including receptions and a grand ball, a pageant in the park, and excursion trips to the great industrial plants and to the scenic wonders of Niagara Falls.

The congress is open to all persons interested in school hygiene, who may join as regular active members upon the payment of a $5 fee. Application for membership should be sent to Dr. Thomas A. Storey, College of the City of New York, New York city.

Death of Prof. Slaby

PROF. ADOLPH C. H. SLABY of the Charlottenburg Hochschule, died on April 6th, at the age of sixty-three. He was a pioneer in the field of wireless telegraphy. His first experiments were begun in 1897 on his return to Germany after having assisted Marconi with his work in England. With the aid of Count Arco he developed the system known as the "Slaby-Arco," which later was combined with that of Braun to form the "Telefunken" system. By using captive balloons to support his antennæ, he was, in his early experiments, able to establish wireless communication over a distance of twenty-one kilometers (12 miles). Slaby discovered that the coherer is sensitive to difference of potential rather than to variations in current strength, and hence to produce the maximum effect it should be placed at the upper extremity of the antennæ. As such a location would be inconvenient he modified his system by adding a horizontal wire of equal length to the vertical, but for convenience coiled into a helix, and placed his coherer at the end of this wire. Prof. Slaby also contributed much to the tuning of wireless telegraph apparatus, using in the receiving set the syntonizing coil with sliding contact, so familiar to all wireless telegraph operators, which was invented by his associate, Count Arco.

The Intractable Missouri-Mississippi System

IN our front page illustration this week, we have attempted to present in tabloid form some statistics concerning the longest and in many other respects, as well, the greatest river system in the world. The Mississippi River is only about 2,500 miles in length, and the Missouri River is well under 3,000 miles from its source in the Rockies to the point where it enters the Mississippi, but its total length *via* the lower Mississippi to the Gulf of Mexico is 4,200 miles. How this compares with the largest rivers of other continents is shown graphically in our front page illustration. Even considered alone, the Mississippi River equals in length the longest river in Asia.

The heart of the North American continent drains into the Missouri-Mississippi system. Two fifths of the total area of the United States is comprised in this vast funnel-shaped river basin. No wonder this enormous body of water is dreaded when in flood, and yet the very vastness of the basin it drains mitigates the danger; for the chance of a combined flood from all the tributaries of the river is remote. As pointed out in the report by Col. C. McD. Townsend, president of the Mississippi River Commission, in the current SUPPLEMENT, the entire Missouri-Mississippi drainage area receives its water from the Gulf of Mexico, and it is the prevailing wind that determines whether a flood shall originate in the northwest, the north or the northeast portion of this great drainage basin.

What a flood on the Mississippi means is shown graphically by comparing it with the Niagara River. The total discharge through the Niagara is estimated at 280,000 cubic feet per second. The average discharge of the Mississippi River is 610,000 cubic feet of water per second. In time of flood this is increased many fold. A record was established last year when in the vicinity of the mouth of the Red River, the aggregate discharge of the river and the crevasses amounted to over 2,300,000 cubic feet per second. This equals more than eight Niagaras.

In our illustration we have represented this enormous river as flowing into a huge water barrel. In order to hold a single minute's discharge, this barrel would have to have a capacity of 138,000,000 cubic feet, which would make it something like 725 feet high, or a little short of the height of the Woolworth Building. If the river entered into a lake of the size of New Jersey, it would raise it one foot in ten hours. It is when we consider how vast is the amount of water flowing down the Mississippi system that we realize how inadequate would any reservoir system be to keep the flood in check. As a matter of fact, the present levee system is comparable to a reservoir system; for within its confining walls the river is allowed to spread out beyond its normal width, and to many times its normal depth, and yet the waters are uncontrolled. At present the contents of the levees along the Mississippi River amount to 243,000,000 cubic yards, and it has been estimated that 200,000,000 cubic yards more should be added in order to keep the waters in check.

It is interesting to note that the industrious Missouri River carries down in a single year enough sediment to build all of the present levees, and practically all of the projected levees. Out of the Missouri River the Mississippi receives annually 400,000,000 cubic yards of sediment. How much this is we may realize by comparing it with the total excavation from the Panama Canal, which is estimated at about 210,000,000 cubic yards. In our illustration we show a dump car of a standard 12 cubic yard type, but enlarged proportionately until it is big enough to hold the entire excavation of the Panama Canal. This car we find is nearly a mile in length, measured inside the body. A similar car, large enough to receive the annual sediment of the Missouri River, would have to measure, inside, 6,100 feet in length, and the body would cover over twenty-four city blocks. This we have illustrated by displaying a section of Broadway's sky line under the car. Such a car would have wheels larger in diameter than the Singer Building, and only the Woolworth Building would reach up to the car sills. This estimate of sediment is based on a report by Col. Suter, who made observations at St. Charles, Mo., from February to October, 1879. He showed that the average sedimentary discharge was 2.3 cubic feet per thousand cubic feet of water, and this rose to a maximum of 14.7 cubic feet of sediment per thousand cubic feet of water. Four hundred thousand cubic yards per year means 12.7 cubic yards per second; that is over a carload. In other words, if this sediment were carried by rail it would take an endless train running continuously, day and night, all the year round at the rate of seventeen miles per hour to deliver the material in the same volume as it is delivered by the Missouri.

A New Method for Inducing Immunity Against Disease

IN recent years there have been a number of successful experiments on a large scale, with a view to inducing immunity against typhoid fever. It has been found, however, that the method of injecting the preparation under the skin is in some cases accompanied by disagreeable consequences. The use of the hypodermic injection is also by itself an additional danger point, for in the hands of careless workers there is danger of blood poison. For these reasons many investigators have sought for another method of "vaccination" against typhoid fever. Prof. Jules Courmont of the University of Lyons has found such a method.

With the aid of his assistant, Dr. A. Rochaix, Dr. Courmont first tried to introduce the vaccination material through the mouth of the animals with which he experimented—rabbits, goats, and guinea pigs. The material used consisted of a quantity of the typhoid "toxin" prepared by cultivating the bacilli in special mixtures and then heating the mass to about 128 deg. Fahr. The heat kills the bacteria, but does not affect the poison. If a small quantity of this is introduced into the body, the white corpuscles are induced to secrete the appropriate anti-toxin, and thus prepare the blood against a possible larger invasion in the future. But it was found that swallowing the "toxin" did not produce the desired results. This can be understood when we consider that the action of the juices of the stomach, the liver and the pancreas upon the toxin must either have destroyed it or modified it considerably before it could be absorbed into the blood through the walls of the intestines.

When it was demonstrated that this method was not efficacious, Prof. Courmont conceived the idea of getting the material into the large intestine *directly*. For this purpose he used the same animals and gave each a number of irrigations: the results were entirely satisfactory, the animals becoming completely immune to typhoid germs. To make sure that the method would apply to human beings, the same experiments were repeated with a number of volunteers. Each received three enemas containing about three ounces of the killed typhoid culture at intervals of five days. As it was of course impossible to infect the young men with typhoid germs in order to find out whether this intestinal "vaccination" was effective, another method had to be resorted to. That was testing the behavior of the blood in relation to the specific microbes. Now in every case experimented upon it was found that the serum of the subject's blood killed cultures of typhoid bacteria. And in no case was there any unfavorable or even unpleasant reaction as a result of the treatment. This method promises much for our future health.

Intestinal vaccination of the same kind was also tried on the experimental animals, using the bacteria of "blue pus" instead of typhoid bacilli. The induced immunity was complete in every case.

The Current Supplement

THE most important official exposition of the problem of controlling the Mississippi flood is unquestionably a paper read before the recent National Drainage Congress in St. Louis by Col. C. McD. Townsend, U. S. A., president of the Mississippi River Commission. This address is published in full in the current issue of our SUPPLEMENT.—The Stefánsson Arctic Expedition is discussed by Rear Admiral Peary and Mr. Clark Wissler.—Mr. Eastick contributes an article on the hardness of metals.—A paper mill engine of new design is illustrated and described.—Mr. G. B. Cortelyou's review of the development of the gas industry is concluded in this issue.—An automatic railway signaling system devised by an Australian engineer is described.—Safety lamps for miners have occupied the attention of many, since the days of Sir Humphry Davy.—An article in this issue deals with electric lamps for miners.—The fifth of Sir J. J. Thomson's lectures on the structure of the atom is reported this week. The sixth and last of this important series, in which the great English physicist summarizes the main conclusion of his brilliant researches, will appear in next week's issue.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN:

Why, in the name of common sense, does not some one call attention to the construction of flood channels in cities, due to reclamation of bottom lands, bridge piers, abutments, etc., as a cause of floods by reduction of channel cross-section. Now I have been very glad to see that point, which was discussed considerably in Kansas City, in 1904, taken up in your last issue, but I have one suggestion yet left to offer, viz., is it not true that the river channels have been choked, also, by the greatly increased quantities of soil washed into them from the large areas of plowed ground now found in their drainage areas? Early explorers reported many of our streams as clear, which certainly have not that character now.

Plattsburg Barracks, N. Y. G. W. EDGERLY.

The Futility of Reservoirs to Control Floods

To the Editor of the SCIENTIFIC AMERICAN:

Your idea, that the reservoir system of preventing floods in river valleys would be of but little benefit, is well supported by the recent great flood in Ohio and Indiana.

Our river valleys were full of water, from source to mouth of stream, to a greater height than any engineer would propose for dams. This condition prevailed for a period of three or four days. If we consider the high velocity of flood waters, we can readily see what a small portion of this water could have been held back by reservoirs. The breaking of dams, had they been in existence, would doubtless have added to the destruction of both lives and property, since people would have been less willing to leave their homes.

Nor would levees have afforded protection on this occasion. The only way to prevent losses, due to a rain like that of March 24 to 27, is to completely abandon all the creek and river valleys. That we would not think of doing, since so heavy a rainfall may not again occur in several centuries.

We have seen the streams in the condition which they must have often been during the glacial epoch.

Danville, Indiana. C. A. HARGRAVE.

An Advocate of Headwater Control

To the Editor of the SCIENTIFIC AMERICAN:

Articles on the Mississippi will be of peculiar interest this year, and the better control of discharge may be the next great national work. A recent article, interesting and plausible, would tend to claim that Nature was elevating the bed of the river itself, through deposit, and that at the same time man was raising the dykes and the overflowed sediment raising the general level of the submerged land. This does seem to be Nature's process, but unless it had only local effect, it would finally create rapids at the sea, for the level of the sea will not rise to accommodate the raised bed of the river. However, rapids have not appeared to any extent as yet.

It would be of interest to know what the engineers say of this theory. Higher, larger, and better dykes would tend to scour the present channels better than ever, but will they accommodate the volume of water that must pass within a limited time?

If they will not do so, then they are only moderately useful and will not meet the greatest emergency. The control of headwaters would certainly have great effect, both on average flow and also on flood. Extra accumulations of water from various sources are at times compelled to pass the lower reaches of the river within a certain number of days, and if they cannot do it overflow is the result; and the trouble is on that stretch of river where the accumulated waters bunch up temporarily, and an improved mouth to the river would not be of assistance just there.

It would seem that control of headwaters in conjunction with the ability to heavily sluice out water at certain possible points, when the river at those points reached a certain stage, would be the only remedy, excepting that dykes on a larger scale should be still used at points where proved necessary. Partially to close off certain headwaters in case of heavy rains at all headwaters could not fail to have great effect. To hold certain waters back but a few days would have great effect. Time is the chief item in the whole flood question, and the only water that must be controlled is the excess that passes certain stretches within a certain time. VERITAS.

Montreal, Canada.

Swamp Drainage and the Floods

To the Editor of the SCIENTIFIC AMERICAN:

I noticed in your issue of February 15th, an article on the overflow of the Mississippi River a year ago this spring. Now in my opinion you are on the right track only you do not make it strong enough. Now I am building dry land dredges and my business calls me to different parts of the United States, and I have a chance to see what a vast amount of drainage is going on all over the country; wherever there is a chance to drain a lake, a slough, a swamp or low land, it is being done. Many of these heretofore have had no outlets, and where they did have, the outlets were many times obstructed by old logs or beaver dams or other obstructions, and many of them had no outlets at all. The water had to soak away or evaporate, which all contributed to hold back the water. Now this is all changed, or is being changed; so where it used to take two or three months to get the water off it now goes off in two or three days, and when this is being done in a vast stretch of country the most of which empties into one river, its effects must be felt, especially when it has to be narrowed up by levee and has to run in a comparatively narrow channel, where it used to spread out over several States. It is estimated that in the State of Minnesota alone there will be this coming summer 100 dredges at work and these will probably dig 1,000 miles of ditch, a large part of which will empty into the Mississippi, and some of these ditches are small rivers themselves, and this work has been going on for several years, and will be continued for some years to come. And this is but the index of other States.

Now this building of the levees along the Mississippi just high enough so that the high water just runs over the top and washes out enough to let the whole country along the Mississippi be flooded, and the next year the levees are raised a few inches higher, is not providing against a flood. This is not even providing for the extra demand which has to be taken care of from the extra ditches. We can hardly comprehend or estimate the immense amount of water that the Mississippi will be called upon to take care of at certain times of the year, when there are heavy rains in some parts of the country and heavy snows in others extending over a vast country reaching from the Rocky Mountains on the west to the Alleghany Mountains on the east, and from Canada on the north to the Gulf of Mexico on the south and draining approximately one million square miles of territory.

Now, as it looks to me, the only way is to build the levees that we think are high enough, and then add onto them from 50 to 100 per cent in height, and by that means they may be built high enough to stand any flood that may come. And then, too, we may as well count on adding some more, for sooner or later the United States will be called upon to take care of the extra water being drained into the Red River of the North from all the extra ditching going into it from Minnesota and Dakota, in consequence of which there is bound to be sooner or later high floods along the Red River and the United States will be called upon to settle for damages caused by the extra water that the Red River could not take care of.

Tomah, Wis. A. N. CROSS.

Dams to Control Floods

To the Editor of the SCIENTIFIC AMERICAN:

A partial remedy for flood conditions as now exist has occurred to me; and as I have not seen it suggested in my reading, I will mention it.

The usual plan for controlling the heavy rainfall and ordinary spring freshets implies making large reservoirs, in deep valleys, by great masonry dams. Such a measure costs large sums of money, which, with the physical difficulties, defer or prevent anything being done until repeated catastrophes rouse an overwhelming sentiment in their favor.

I have visited much of this country, have observed its contour, and make the following suggestions:

Almost every stream has wide shallow valleys bordered by meadow land; what are called bottoms in many places. Generally before these floods, such as prevail to-day through the Middle West, the streams are low, and these valleys are not filled with water. When the heavy rain comes the water rushes down the streams till it reaches some narrow place, and at such points it begins to back up, and temporary dams are made by the accumulation of material brought down by the streams. The increasing pressure of the waters held back often becomes so great as to break through the temporary or artificial dam, and the volume as well as the force of the water sweeps all before it.

My suggestion is that low dams be put at many places in the course of streams, which would hold back the waters in shallow valleys, so that the floods would flow away gradually and harmlessly.

The fertility of the valleys of the Nile, the Mississippi, and other alluvial streams is due to the deposit on them of the silt carried in rapidly moving water; and such an annual deposit on the flat borders of streams, which would overflow their banks in times of high water only, would greatly and perpetually enrich them, while the damage would be small compared to the very great damage now done, when the water escapes with a rush and an accumulation of force sufficient to sweep dams, buildings, and bridges before it.

I know valleys where at suitable places even an elevated roadway crossing it, with suitable spillways, would spread the flood over wide spaces, to run off harmlessly later.

Earth dams with a core of masonry, when not exceeding 10 or 15 feet in height, would cost little, and if put at rather short distances apart, along the course of streams, would curb the violent flow of the water; enrich the land; and in partially dry regions, like western Kansas and Nebraska, impound water which would be of great value in times of drought. The expense of such low dams, often combined with improved roads, now so much in demand, would be well repaid by the freedom from such disasters as now shock us all, by the increased comfort and convenience of the people along such rivers as now overflow; and by much increased fertility to the bordering valleys.

White Plains, N. Y. SAMUEL B. LYON.

A Protest Against Amateur Flood-Controllers

To the Editor of the SCIENTIFIC AMERICAN:

I have watched with mingled feelings of amusement and disgust the lucubrations of amateur meteorologists and hydrographers, as set forth in the New York daily newspapers, with reference to the recent floods in the West. I observe that you have admitted one of them to your correspondence columns, Mr. C. A. Zander of Littleton, Del., who remarks: "I am sorry to note the stand you take in the matter of straightening out a river in your otherwise sane views of flood restrictions."

I presume this gentleman is new to the SCIENTIFIC AMERICAN, or he would know that the SCIENTIFIC AMERICAN is always sane, in all particulars. In this particular item of floods, you made recently the first sane statement I ever saw in print regarding the tiling and ditching and drainage of land, which every farmer gets busy with as soon as he cuts off the forests, as a cause of the sudden flooding of streams.

Wise and sapient words, these of Mr. Zander: "The problem of the Mississippi is the same as that with a brook, save in magnitude and constant level at outlet. A straightened bed will lower the flood crest," etc. This is at par with the rare and wonderful thoughtfulness of the Secretary of the Interior, who advised the people of Ohio to dig "runways for the floods." I have before me a photograph showing the Ohio River at Cincinnati at a stage fully six feet below the recent high record. The river reaches from the Kentucky hills, some four hundred feet high, to the foot of the hills on the Ohio side. All that is necessary in order to carry out the Secretary's brilliant plan is to set those hills back, perhaps half a mile, for a distance of some 700 miles—and then dig the "runway"! Mr. Zander's idea of the Mississippi is equally comprehensive, brilliant, and practical. "Begin at the mouth, straighten channel any distance, make waterway wide enough and dyke high enough to take flood, with a good margin of safety added." Does this gentleman know that the Mississippi River carries at flood tide enough water to cover his delightful little State more than four feet deep in a single day? Does he know that the Mississippi River drains an area about 700 times the size of the State of Delaware? Did he ever watch tall trees falling into it, one after another, as it carved land off the banks by the township?

I see no reason why his blithely propounded formula could not be applied to even greater affairs. For example, a bridge across the Atlantic: "Build your piers high enough, above flood tide, connect them with trusses, and lay your tracks." Or a railroad tunnel straight through the earth: "Dig a hole deep enough, shore it up safely, provide an elevator to the center and a corresponding one on the other side."

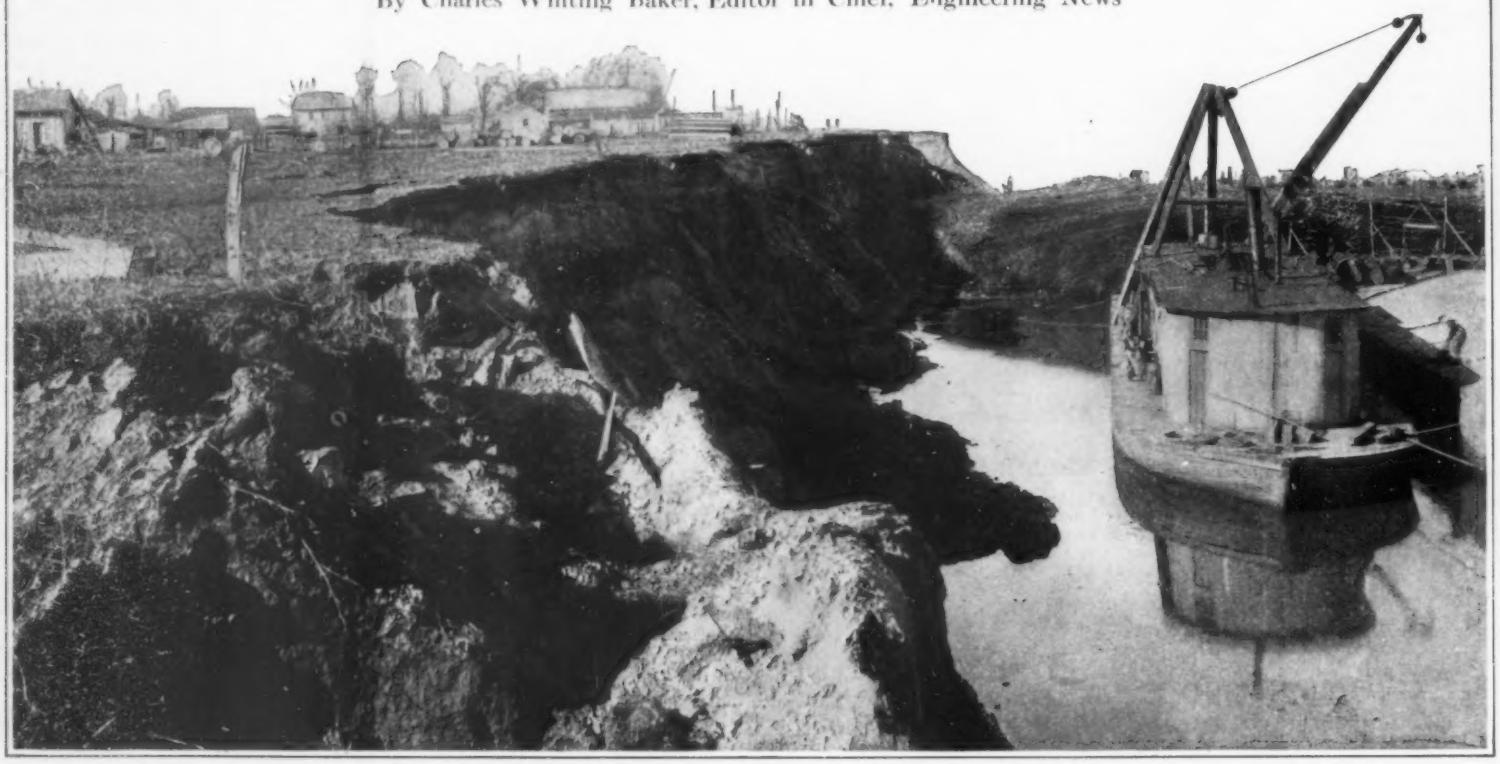
No doubt improvements will be made in the control of the Mississippi, as well as in the control of the floods in all parts of the Ohio River watershed; but the work will be best accomplished by people who live there, people who have lived through the floods, and who have some sensible conception of the size of the job. And after all the flood controlling is done, Nature some day will turn loose a heavier rainfall than man had ever seen before, and the flood defenses will operate simply as a means of sudden precipitation of the calamity, when they yield before Nature's power!

I have seen the Mississippi River eight miles wide at St. Louis, with a current of nearly six miles an hour, and I protest against the annoying of people who are suffering from the ravages of the flood at this time by nonsense from engineers of the kindergarten stage, whose fields of observation have been spring tides in the Erie Canal or the gaging of some creek whose annual flow would not equal the Mississippi's rate per minute. Furthermore, I have full confidence that the SCIENTIFIC AMERICAN's outgivings on the general subject of flood control will continue to be not only partly sane, but entirely so. WALTER C. TAYLOR,

Boston, Mass. Editor *The Boot and Shoe Recorder.*

Floods and the Problems of River Regulation

By Charles Whiting Baker, Editor in Chief, Engineering News



Condition of caving bank at Caruthersville, Mo., at the time of beginning bank protection work.

THE heavy rainstorm which swept across the country from Illinois to New England during the first week in March caused greater property damage than any other storm that has ever visited the United States. Public attention has been largely concentrated on the loss of life and property in such sorely stricken cities as Dayton and Columbus; but there were numbers of other smaller cities and towns in Ohio in the valleys of the Miami and Scioto and Muskingum rivers which suffered as severely. In fact, all through southern Ohio and Indiana, and the whole length of the Ohio Valley, every town and city located on a river bottom sustained heavy loss.

So widespread were the floods, reaching eastward through northern Pennsylvania across the State of New York and even into New England, and westward and southward along the Mississippi River to the Gulf of Mexico, that nothing short of a census enumeration could determine approximately the damage suffered by probably a hundred thousand households and as many farmers in injuries to land.

Immediately following this widespread destruction there has arisen a public demand that something be done to guard against like destruction in the future. Bills are being introduced in Congress; prominent public officials are expressing opinions; the daily newspapers are making divers suggestions. It is important that the public should have an intelligent understanding of the subject.

And in the first place it may help us to form sound opinions if we understand that there are clear and definite limitations as to what is possible of accomplishment. After all, man is a puny creature compared with the mighty forces of Nature. He has indeed harnessed some of these forces; but he has been able to do this only by studying the laws which govern these forces and working in harmony with these laws. Long ago the work of the engineer was defined as "the harnessing of the great powers of Nature for the service of man." It is the engineer's business to know what can be and what cannot be done with these forces.

The Cause of the Recent Floods.

The first thing an engineer does when he sets about the solution of a problem is to measure and weigh the quantities with which he has to work. As soon as the news of the recent floods came, engineers set to work to determine the rates of rainfall which caused them and the volume of flow in the flooded streams at various points. It is now known that the rainfall which caused these great floods was phenomenally heavy over a belt of country stretching across northern Ohio along the low and flat divide between the rivers which flow north into Lake Erie and those which flow south into the Ohio River. At Marion, Ohio, 10.60 inches of rain fell in four days; at Bellefontaine, 11.16 inches; at Bangerville, 30 miles east of Marion, 9.50 inches. This is as much rain as ordinarily falls in the space of three months in this section. It fell at a time moreover when the ground was already saturated and when there was very little evaporation, so that almost the whole of this enormous amount of water flowed quickly off into the streams. It was the long time that this steady downpour continued and not the amount of rain falling in a single hour which caused the damage. A summer thunderstorm often delivers a heavier precipitation over a small area for a few minutes or even an hour than fell in the same time in this Ohio storm. Such heavy thunderstorms over a small area often do excessive damage in the washing out of roads and culverts through the overflow of brooks and small streams. In the Ohio floods, however, hardly any of the small roadway culverts were washed out; but the bridges over the larger streams were carried away, proving that it was the long duration of the steady rainfall, extending over a wide area, which was responsible for the great damage.

One of the most common and widespread fallacies with reference to floods is that they are more frequent now than in former years, and attain higher elevation, and that this is due to the clearing of the forests and the cultivation of the land, the draining of swamps, etc. This idea is so firmly rooted in the popular mind that it will probably surprise many to hear it called a fallacy, especially as many distinguished men have given the theory prestige by their support.

It must be said nevertheless that in the opinion of the highest scientific authority the presence or absence of forests on a watershed has very little influence on floods in the streams which flow from it. It is another common fallacy that the presence of forests increases the amount of rainfall. There is no satisfactory evidence that this is the case, at least under the climatic

Crevasse in the levee at Wilson, Arkansas, taken from the south end of the break.

Part of the broken end of the levee is shown in the foreground, the other end is beyond the trees. The water is pouring through this half mile break with a ten-foot head and is flooding an area forty miles wide and one hundred miles long.

conditions that exist in the United States.

The idea that the climate is gradually changing stands on no more substantial basis, when one studies the weather records extending back not merely over the few years that the average person remembers but over a half century or a century. There is no reliable evidence that there has been any appreciable change in climate, so far back as authentic historic records extend.

There are, however, from causes not fully determined recurrent cycles of wet years and of dry years. Such a cycle of dry years, for example, during which hundreds of cities in all parts of the East suffered from insufficient water supply as a result of the drought, came to an end about two years ago. As according to the old adage, one extreme follows another, we are apparently now beginning a cycle of wet years during which the average annual rainfall will be excessive instead of insufficient.

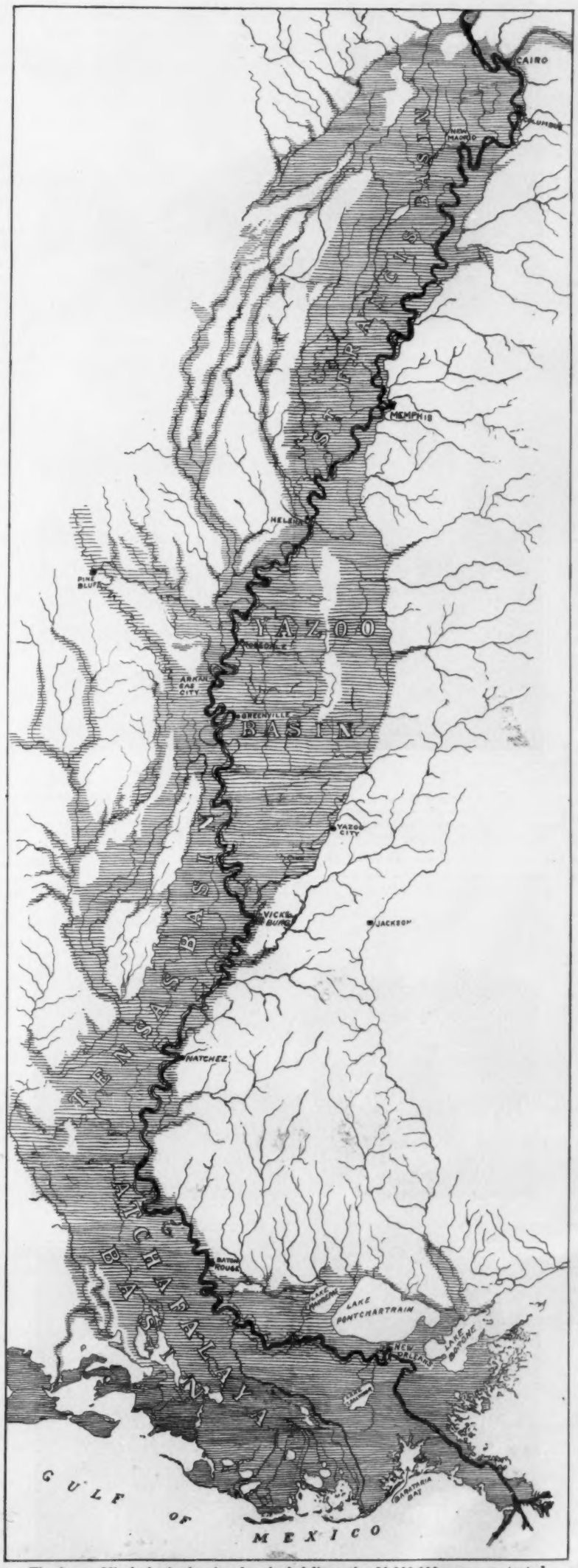
Forests and Floods.

It may be of interest to explain some of the reasons why the presence of forests upon a watershed has comparatively little effect upon floods flowing from it. That it does have some influence in equalizing the rate of runoff from a drainage area *during periods of ordinary rainfall* is well understood. But the mulch of dead leaves which covers the ground under forest trees has only a limited capacity for absorbing water. According to the depth of this mulch and the character of the underlying soil, this mulch may be able to absorb like a sponge perhaps half an inch, an inch or even two inches of rainfall. After the point of saturation is reached, however, further soaking in is very slow; and if an additional heavy rainfall comes, it runs off very rapidly on the water surface formed by the rain which has previously fallen.

Some of those who have strongly advocated forest cultivation as a protection against floods have attempted to illustrate the behavior of the forest mulch in absorbing and equalizing rainfall by covering an inclined board with a sheet of blotting paper and showing how the blotting paper absorbs water sprinkled upon it, where water sprinkled on the bare board runs quickly off. But if this little experiment is carried further, it gives an excellent object lesson why forests do not and can not prevent floods. Continue the sprinkling of the blotting paper with water, and after it has become saturated the water runs off as readily as it would from the smooth board without the blotting paper.

This is what happened in the recent Ohio storms. Day after day the rain steadily poured down upon ground already saturated from the winter snows and rains, and as soon as the ground surface was covered with water the additional rain flowed rapidly off on the surface of the water underneath. When it is remembered that the total depth of the rain which fell in this four-day storm was nearly a foot at some points, it can readily be understood why there was a rapid and enormous discharge into the Ohio rivers and why this discharge would have taken place and the great floods have resulted just the same, even if the whole State of Ohio had been covered with primeval forests.

Besides this there are many records of great torrents flowing from regions which were covered with dense forests. An excellent example is the Hudson River. The flood in this river on March 27th to 29th was enormous and caused great damage at Troy and Albany; yet the height which the flood attained and the volume of water flowing in the river were after all less than in the flood which occurred in February, 1857. Now the Hudson River above its junction with the Mohawk receives nearly all of its water from the southern part of the Adirondack region. In 1857 nearly the whole of this region was covered with primeval forest. Better proof that a forest cover upon a watershed cannot prevent great floods in the streams flowing from it could scarcely be given.



The lower Mississippi, showing by shaded lines the 20,000,000 acres protected from inundation by levees.

The lands protected by the levees are wonderfully fertile, and many plantations are valued at $100 to $200 per acre. Breaks in the levees in the great flood of 1912 inundated only a small part of this area.

Old records show also that in 1832 there was a flood in the Ohio River at Pittsburgh, which was five feet higher than the flood of last month. In 1832, however, a very large part of the watersheds of the Allegheny and Monongahela, which meet in Pittsburgh to form the Ohio, was covered with dense forests.

As to the prevalent idea that the cultivation of the prairies and the draining of the swamps has increased the floods in the Mississippi River, it is of interest to note that the greatest flood height on record in the Mississippi River at St. Louis occurred in 1844, and the next highest in 1785. At both these dates the entire territory drained by the upper Mississippi and the Missouri rivers was in its natural condition. The trifling amount of settlement and cultivation at that early period could have had no influence on the rate of runoff.

Similar instances without number could be multiplied, all going to prove that the volume of flood flow in our streams and rivers has not been materially altered by any changes which man has brought about. The floods which have wrought such destruction this year, therefore, are nothing but what have occurred before and will doubtless occur again; and there is no evidence to show that they are likely to come with any more frequency in the future than in the past.

How Far Man is Responsible.

While there is thus no evidence to show that the changes brought about by man, upon our continent at least, have affected the rate of rainfall or of the runoff from drainage areas, so as to have any influence on floods, there are certain changes for which man is responsible which have affected the ability of the river channels to carry these floods.

Where rivers pass through cities their channels have often been narrowed by gradual filling in of the banks on either side. Individual property owners along the shore have a strong temptation to do this because of the additional area of land which they thus secure. Bridge piers and dams in a stream also operate to reduce the channel capacity. Most serious of all, however, are the obstructions which have often been placed across the flood plains of rivers.

As everyone knows, most streams and rivers flow in a comparatively narrow channel through a broad valley and are bordered on either side by broad stretches of meadow or bottom land. These bottom lands are termed by geologists the river's flood plain. They have gradually been built up through long ages past by the deposit of sediment from the river when in high flood.

To man, with his short span of years on the earth, floods high enough to cover these bottom lands seem to come at long intervals

apart, and it seems incredible that these broad plains with their deposits of sand and gravel and silt many feet in depth have all been brought down and deposited by the stream during periods of high flood. The deposits themselves, however, tell a story whose truth it is impossible to contradict. These broad level bottom lands along every stream are proof in themselves that the river has in past ages frequently covered these plains; and while it is true that many such bottom lands probably gained much of their deposit during the geologic epoch following the glacial period, when enormous runoffs and erosion occurred, it is also true that many of these flood plains are the results of deposits made within historic times.

In other words, every river has two channels. The first, its ordinary channel, carries the whole flow of the stream at all ordinary stages; the second, or flood channel, is inundated by floods which may occur on some streams once in a decade, in others once in a half century or century, or perhaps at even longer intervals.

The bottom lands, or flood plains along a river, are invariably fertile and productive, hence they usually support a dense population. Again, nearly all cities and towns are built on rivers of greater or less size. They were originally located there because of the advantage of transportation, or water power, or water supply; and as they have grown they have spread over the flood plain of the river and are subject to inundation, therefore, when once in a century or oftener, a record-breaking flood in the river occurs. The height of such floods is increased, as is also the velocity of the current, by the obstruction to the water's flow by the encroachments on the channel and the buildings and the obstructions built on the river's flood plain.

Still another way in which man has affected the capacity of rivers to carry floods is when by cultivation, forest removal, road construction, etc., he has caused earth and sediment to be carried into the streams, which has tended to fill up the channels.

The amount of this injury to river channels, however, has been probably overestimated by many. The large rivers have suffered little deterioration of their channels so far as measurements can determine. There are, however, certain localities where the work of man has undoubtedly injured the rivers. Most notable are the rivers of California, which years ago received the débris from hydraulic mining.

So far as the rivers whose floods caused such destruction in Dayton and Columbus are concerned, it is doubtful if any material shoaling of their channels had occurred as the result of sediment carried into the streams; the volume of the flood water was so vast that, had the ordinary river channel been as much as five feet deeper or five feet shallower, the flood destruction would have been little affected either way.

To recapitulate, then, the recent floods were caused by an extraordinarily heavy rainfall, and nothing that man has done in removal of the forests, cultivation of the ground, or drainage of swamps had anything to do with it. Such floods have come before and will come again, but at long intervals. To such occasional devastation, every city built upon a river's flood plain is liable; but since floods are not increasing in frequency or in height, the danger is no greater to-day than it always has been.

It must be remembered, however, that the flood plains of a river may be at various elevations. Some parts may be overflowed by such high water as comes every year or even several times a year, some parts are reached only by such floods as come on the average at intervals of five or ten years; other places are inundated only by such extraordinary floods as may occur at intervals of a century.

How Floods May be Controlled.

There are two general methods by which the flood waters of a river may be controlled and prevented from spreading over its flood plains. The first is to build embankments or levees along the river banks so as to confine the waters within the ordinary channel. The second is to build reservoirs upon the tributary streams which form a river and store up in them the flood waters, to be gradually discharged later to supplement the river's low-water flow. The relative merits of these two methods are just now the subject of active public discussion.

The reservoir system is, upon a superficial observation, very attractive. The proposition to store the water which would otherwise rush down the valley creating waste and destruction along its entire path to the sea, and to use this stored water to develop power, to irrigate lands in time of drought or to increase the low water flow of the rivers for the aid of irrigation—all this seems on its face to be an ideal plan.

Moreover, its advocates can point to instances where river regulation by these methods is being actually accomplished. The Croton River, for example, which furnishes New York city's present water supply, has had so many reservoirs built upon its watershed, that unless a very heavy rainstorm should come at a time when the reservoirs were all filled, the entire flow resulting would be caught and stored for the city's use. Boston stores the Nashua River's flow in a similar way. At Panama, the floods in the Chagres River are now stored in the great Gatun Lake, which will become as it reaches its final depth and area the largest artificial body of water in the world. Still again in the arid West, great irrigation works are dependent on the storage of flood waters in huge reservoirs.

The Reservoir System.

It is to be especially noted, however, that all these reservoir systems are on *rivers of small size*. Further, their construction has involved a huge expenditure. The city of New York has spent millions of dollars on a single one of its reservoirs in the Croton watershed. The Gatun dam is an essential part of the $400,000,000 Panama Canal works. Such expenditure can be afforded because of the high value of water used for a city's water supply, or even for irrigation.

When we apply the cost of reservoir construction per million gallons of water stored to the huge volumes of water required to be stored if we are to take care of the flood waters of rivers draining thousands of square miles, the magnitude of the sum required becomes appalling.

During the recent floods at Columbus, Ohio, the volume of the Scioto River's flow where it passed over a great weir dam just north of the city was very accurately determined. In round numbers, at the crest of the flood, the river passing through the city had a volume of 138,000 cubic feet per second. A river in flood with a swift current may have an average velocity of four miles an hour, or approximately six feet per second. Such a river with an average depth of 15 feet would have to be 1,555 feet in width to discharge a volume of 138,000 cubic feet per second.

If the reader will picture to himself some of the natural lakes or artificial reservoirs with which he is familiar and imagine such a great river flood, more than a quarter of a mile in width, sweeping down into it, he can realize how brief a time it would take for such a flood to fill it.

In the city of Columbus, the river covered the entire width of its flood plain, a breadth of over two miles. There are very few artificial reservoirs anywhere which have as great a width as this. When one witnesses such a river as the Scioto, which at lowest water can hardly float a row-boat, transformed into a stream from half a mile to several miles in width, it can be appreciated what vast reservoirs would be required to store any considerable part of the flood flow.

Where could such great reservoirs be

A Lake steamer was broken from its moorings by the force of the current and was carried against the pivot pier of a swing bridge across the river. It knocked the bridge off the pier into the river, causing a loss of a quarter of a million dollars.

Wreck of a swing bridge over the Cuyahoga River at Cleveland, Ohio.

This mat, floating over the section of bank to be protected, is being held in place by wire cables while stone is unloaded from the barges and placed evenly upon it in the cribs provided. It will sink uniformly into place and will extend from the water surface toward the bottom of the river like a great rock curtain. These revetments, as they are called, cost from $28 to $30 a running foot. If the caving bends could all be treated in this way, the channel would remain permanent.

Example of bank revetment work.

Upper bank protection, showing sill dams at Atchafalaya.

Negroes driven from their homes to the high ground of the railroad dump by water from one of the crevasses. Six weeks elapsed before the water subsided.

located? The river which flows past Columbus drains some of the most fertile and densely populated farming regions of Ohio. The dwellers in these upper valleys would resist to the utmost the appropriation of their lands for reservoir bottoms.

Moreover, storage reservoirs can be economically built only where a deep narrow gorge occurs on a river below a broad level valley. Such reservoir sites in northern Ohio are lacking. Still further, in order to have prevented the recent floods by storing the flood waters, reservoirs of huge capacity would have been necessary on the Wabash, White and Whitewater rivers in Indiana; on the Maumee, Cuyahoga, Miami, Scioto and Muskingum in Ohio; on the Allegheny and Beaver in western Pennsylvania; on the Genesee, Mohawk and Hudson in New York, and on a multitude of smaller streams besides. And the next great flood-bringing rainfall may come on an entirely different territory, where these reservoirs would be of no use.

At the recent National Drainage Congress in St. Louis, Col. C. McD. Townsend, U. S. A., president of the Mississippi River Commission, presented a graphic statement, showing how the floods on the lower Ohio and Mississippi rivers are due to rainfall upon their lower tributaries rather than from the distant headwaters in the mountains, where the advocates of reservoir control propose to store the water.

In the recent Ohio River flood, the city of Cairo, at the junction of the Ohio and Mississippi, was so threatened that women and children were sent away and the city was more than half depopulated. The crest of this flood reached a greater height at Cairo than any ever before recorded. Suppose there had been a huge storage reservoir available, not merely on the headwaters of the Allegheny and Monongahela, but at the city of Pittsburgh itself. Suppose there had been another such huge reservoir at St. Paul, Minn., capable of taking all the flow of the upper Mississippi. Suppose another had existed at St. Joseph, Mo., sufficient for the whole flow of the Missouri.

The length of time required for a flood wave to pass downstream from these several points to Cairo is known. Suppose, therefore, that in order to protect Cairo and the lower Mississippi Valley from the recent flood the gates of these reservoirs had all been closed, so that not a drop of water would have been allowed to flow past Pittsburgh or St. Paul or St. Joseph until the flow would be too late to meet the flood from the lower Ohio tributaries and add to the volume at Cairo. Col. Townsend then shows that the recent flood flow of 2,000,000 cubic feet per second, which the river at Cairo attained at its record height, would have been diminished by only 35,000 cubic feet per second by such reservoirs, or *less than two per cent* of its total volume.

Limitations of space forbid a further explanation of the inherent difficulties which make control of the floods of great rivers by artificial reservoirs as difficult and impossible in practical execution as it is attractive when viewed superficially.

Merits of a Good Levee System.

Attention may be turned therefore to the levee system of river control, which has been adopted by engineers the world over to protect the flood plains along a river's course from inundation. In the United States the best known example of river control by levees is the lower Mississippi River. This river is now bordered on either side by levees having a total length of some 1,525 miles, containing nearly 250,000,000 cubic yards of earth. These levees protect from inundation some sixteen million acres of lands as fertile as any on the globe. In its present condition the levee system is sufficient to confine all ordinary floods, and in all the years from 1897 to 1912 the floods of the Mississippi were held between the levees except for a few small breaks in 1903. The extraordinary flood of 1912 and the one which is now passing down the river have each exceeded all previous records in volume; and will doubtless result, as they should result, in large expenditures to raise and strengthen the levees and to revet caving banks along the rivers.

That a few weak places in the levees failed in last year's flood and this year is no fault of the levee system, but is due to the fact that the levees have been built, not to the height and the width and the strength that engineers knew to be advisable, but to such dimensions as the land owners along the river were willing to tax themselves for. To raise and strengthen the levees so that they would be safe against floods much higher even than those of the present year would cost less than $4 per acre of land protected; and as much of this land is worth $100 per acre or more, it will be seen that such strengthening of the levees is easily practicable financially at the expense of the property benefited.

It is doubtless too much to expect that the general public, deceived as it is apt to be by the pseudo-science of the newspapers, will form correct opinions on such matters as river regulation and flood control for a long time to come. It may be hoped, however, that the public will learn to rely in such matters on the opinions of expert engineers. Already the Secretary of War has convened a board of engineer officers to report upon the recent floods, and there may eventually result a Federal engineering organization which will deal with matters of river regulation for the country at large, at least where interstate rivers are concerned.

The prehistoric mounds of "mound builders" are sometimes thirty feet high and one hundred feet in diameter.

Live stock which has taken refuge on a prehistoric mound.

It is not for a moment to be expected that such an engineering organization could perform such impossibilities as the general prevention of floods; but it could have jurisdiction over river channels to prevent their improper obstruction and narrowing. It could advise a city or a State as to what protection in the way of levees or land elevation by filling was requisite for reasonable protection against floods, and it could control the construction of reservoirs for water power, irrigation, water supply, etc., so that State boundaries should not stand in the way of providing for the greatest benefit to the greatest number of people with the minimum of expense.

This is the levee line along the St. Francis Basin; it extends from Point Pleasant, Missouri, to Helena, Arkansas—a distance of two hundred miles. When a break like this occurs, three million acres are flooded if the entire basin fills up. This view is taken from the inside and shows the height of the earthen wall that is holding back from ten to twelve feet of water at the river side.

A pen built around a leak on the inside of the levee with sacks of earth.

The Death of Carl Hagenbeck

ON April 14th, Carl Hagenbeck, the well known dealer and trainer of wild animals, died at the age of sixty-nine. He supplied many of the zoological gardens of the world as well as many circuses with their collections of wild beasts. His famous private zoological garden in Hamburg has been described in these columns. Our readers will recollect that instead of confining animals in cages, he allowed them to roam at will in the open air, preventing their escape by means of ditches filled with water.

Antiseptic Properties of Tobacco

LIKE many other narcotic poisons, nicotine has certain properties which give it definite value in medicine when employed in the proper way and by competent agents.

Thus poultices of fresh tobacco leaves have long been employed to give relief in cases of gout, neuralgia, and rheumatic pains. A concentrated solution of the fresh leaves is said to be good for dandruff, ringworm, etc. Tobacco is also employed as a remedy for skin diseases of cattle, and is commonly used to destroy parasites in vineyards and orchards. Recent investigations showing its high value as an antiseptic agent are summarized in *Le Correspondant* (Paris) from which we quote: The researches of Tassinari and Molisch have now demonstrated the actual antiseptic value of tobacco with regard both to vertebrates and to inferior creatures.

Tobacco smoke serves to retard or arrest the development of certain pathological bacteria. Amœba, ciliated infusoria, etc., soon die in the tiny glass cage in which they are placed for study under the microscope, if a single puff of tobacco smoke be injected therein. It seems to act upon them as an anesthetic, exactly as do the vapors of ether and chloroform.

This bactericidal and antiseptic action has not yet been fully elucidated, but the Italian physiologist Cavarallo has proved (*La Stomatologia*, Milan, 1910) that smoking not only increases the flow of saliva (which probably explains the uneasiness of smokers after eating until they are able to indulge in pipe or cigar) but also sterilizes it. He also declares that tobacco is never the cause of oral inflammation and the epithelial tumors of mouth and tongue, though it may be the determining agent which makes such causes, which are many and complex in character, active.

When these statements of Cavarallo were published they roused much controversy, being bitterly attacked by the enemies of tobacco, though they were supported by a series of clinical experiments. His conclusions, however, have just been brilliantly confirmed by the work of Prof. Wencke of the Imperial Institute of Berlin, who made many experiments during the recent cholera epidemic at Hamburg.

Prof. Wencke was struck by the fact that the workers in the cigar factories of that city were not attacked by the scourge, even when living in surroundings similar or identical with those of its victims.

On making investigation he found that the water employed in one of these factories contained considerable numbers of septic vibrions, yet none of these was found alive on the finished cigars. This led him to definite experiments. Some of the tobacco leaves were moistened with water containing the bacilli of cholera in the number of 1,500,000,000 to the cubic centimeter. At the end of 24 hours these were all found to be dead.

A second experiment was made with saliva containing cholera germs, placed on a glass plate and exposed for 5 minutes to tobacco smoke, which completely sterilized it.

Finally it was found that a fumigation of from 25 to 30 seconds with tobacco smoke sufficed to disinfect the *dejecta* of patients seriously affected by attacks of cholera.

It is believed that other harmful microbes will be shown by future experiments to be similarly destroyed.

A Silicious Wood Preservative

TECHNICAL journals have recently mentioned the impregnation of timbers with melted paraffin and naphthalene, but the new Marr process is a great advance on this method. Diatomaceous earth, a silicious material, is ground so fine that ninety-two per cent passes a two-hundred-mesh screen. This is mixed with the melted paraffin and the naphthalene and timbers immersed in the mixture for four hours. As compared with the twelve to twenty-four hours required in creosoting, this is noteworthy. Furthermore, it is an open vat process. The wood is permeated to the center and resists the attack of marine borers and decay besides gaining in resilience. Nails hold better and do not rust nor does the wood become waterlogged. Hardwoods like white oak which resist other treatment yield to this preservative. The expense is small, for the mixture costs only three cents per pound and less than two pounds of solution are required for each cubic foot of timber.

The Hydro-Aeroplane Meet at Monaco

Description of the Machines and the Tests Which They Had to Undergo

WE illustrate on this page some of the score or more hydro-aeroplanes and flying boats which took part in the second annual meet at Monaco. While nearly two score machines were to compete in this meet, but sixteen qualified by being exhibited prior to the meet on April 3rd. These included three Deperdussin monoplanes, two Nieuport monoplanes, two Borel flying boats, two Astra biplanes, two Breguet biplanes, one d'Artois biplane, one Morane monoplane and one de Marcay monoplane with foldable wings. These machines were arranged in four rows just inside the harbor line, as shown in our illustration. Three or four of them made their first flight at this meet on the 3rd ultimo. In the evening, however, and throughout the whole of the next day, a heavy gale prevented any flying, and the machines were obliged to be sheltered with the exception of two—Prevost's Deperdussin and the de Marcay foldable-wing monoplane, both of which rode out the storm at their moorings. The latter machine was illustrated in the SCIENTIFIC AMERICAN something over a year ago. It is a novel machine, the wings of which are arranged to pivot around an axis near their inner end and to fold back alongside of the body of the monoplane.

No flying of any account occurred again until Sunday, April 6th, upon which day preliminary flights were begun. Gaubert on the Maurice Farman and Labouret on the Astra biplane, together with Weymann and Espanet on Nieuport monoplanes, accomplished the starting, towing, and navigability tests. Gilbert on a Morane monoplane carried out the first, and Bregi, on the Breguet biplane, the last of these three tests.

The following day Labouret's Astra biplane landed on one wing and capsized with serious result. The three Deperdussin monoplanes were also put out of commission, seemingly from striking the water too sharply. Fortunately, this did not happen until after Prevost had succeeded in completing the three tests above mentioned, and also the altitude and volplané test as well, he being the only one to accomplish the two latter tests up to that time. The two Borel monoplanes completed the starting, towing, and navigability trials while Gaubert and Bregi finished. The various tests to be made were divided under six heads, and were as follows: (1) The starting test. After the machine had been brought to a standstill on the water, the motor was stopped and the pilot obliged to start the motor with the sole assistance of the passenger and without touching the propeller, and then to cover a distance of 100 meters between two lines of buoys.

(2) Altitude Test.—The machine must rise from the water to a height of at least 500 meters and return to the water in less than thirty minutes.

(3) Volplané Test.—The machine must rise from the water to the height of at least 100 meters, shut off the power, and glide to the surface.

(4) Handling Test.—The machine must be brought to the crane and fastened to same so that it could be raised and lowered without damaging it.

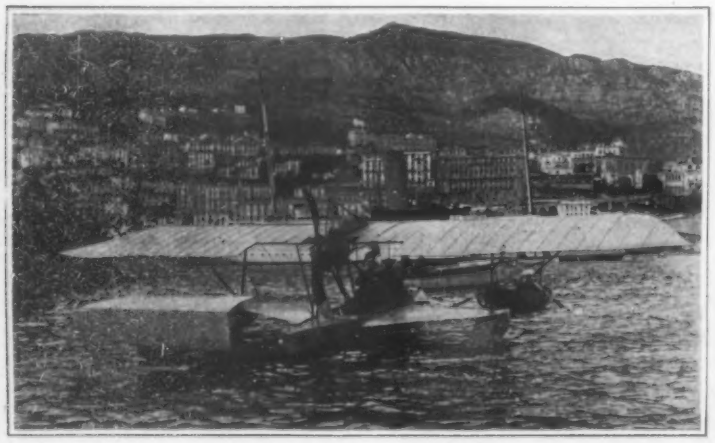
(5) Towing Test.—The machine must be towed by a rowboat or motor boat over the course used in the first test.

(6) Navigability Test.—The aeroplane must circle a course of 6¼ kilometers under its own power without leaving the surface of the water. All the above tests except No. 4 took place outside of the harbor in open water. As the result of this, Fischer had his Henry Farman biplane pretty well smashed by a descent into the water when he was flying in a terrific wind of forty miles an hour velocity early in the meet, while Louis Gaubert was drowned as a result of his machine diving below the surface when he was skimming close to the waves on April 16th. The accident is said to have been caused by the tip of one wing striking a wave, whereupon the aeroplane dove beneath the surface, causing the aviator to be drowned before he could free himself. This is the most remarkable hydro-aeroplane fatality which has occurred, and it was probably the result of flying too close to the water when there was a heavy sea.

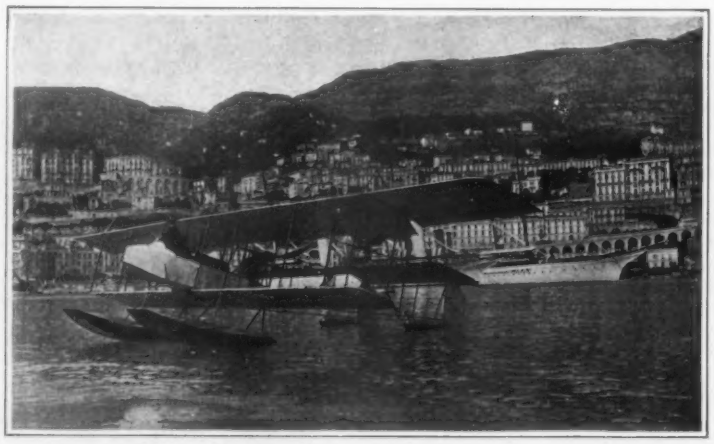
The race for the Jacques Schneider International Aviation Cup for Hydro-aeroplanes occurred on April 17th, and was won by Maurice Prevost on his 160 horse-power Gnome-engined Deperdussin monoplane. The race was over a course of 150 nautical miles, and besides the cup there was a cash prize of $5,000. The photograph of his machine with the completely inclosed motor, having a central rounded shield, is reproduced herewith. The race was an international affair, with Charles T. Weymann representing the United States with a Nieuport monoplane. Garros with a Morane monoplane and Espanet with another Nieuport represented France.

Early in the race Garros experienced engine trouble and had to alight upon the water and be towed back for repairs. After his second start, he again had engine trouble and was again towed into port, but as Espanet had abandoned the race, Garros took heart and started for a third time. Prevost, of course, reached the finishing line first, but he was skimming along on the surface of the water and was not flying. It was decided that he must cross the line once more, this time in full flight, in order to win. Weymann, who was pressing him close, was obliged to descend on account of motor trouble. He had failed to carry enough lubricating oil to finish the race. Also, not knowing that Prevost was obliged to cross the line again, he quit without attempting to finish. Garros was still flying when Prevost made his second crossing of the finishing line, but he immediately landed and withdrew when he saw the race had been won. The race was flown under ideal weather conditions, but it was not at all exciting on account of the numerous motor failures.

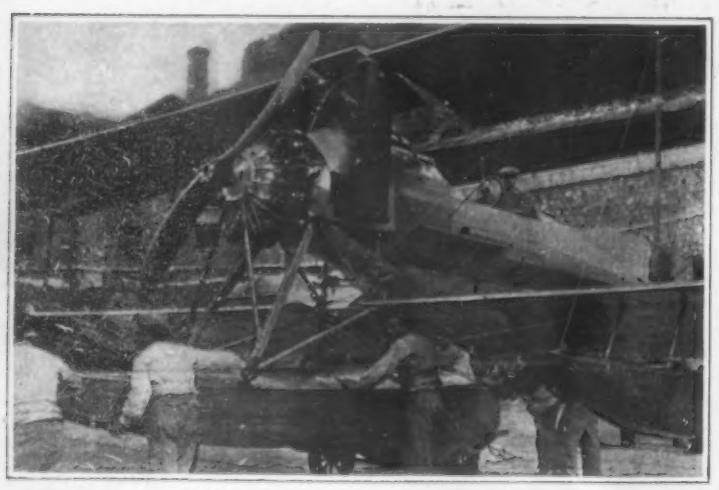
As for the machines which participated in the Monaco meet this year, most of these were equipped with double floats. There were several examples, however, of single float equipment, such as that shown on the Breguet biplane fitted with a 200 horse-power, horizontal, circular Salmson motor illustrated in one of our pictures. Whether there is a single or double float under the front of the machine proper, there is always a small float under the tail to carry the weight in the rear. In the case of the Henry Farman biplane, two cylindrical floats were used—one on each side at the rear. The single floats are generally notched and are in reality single step hydroplanes, but when double



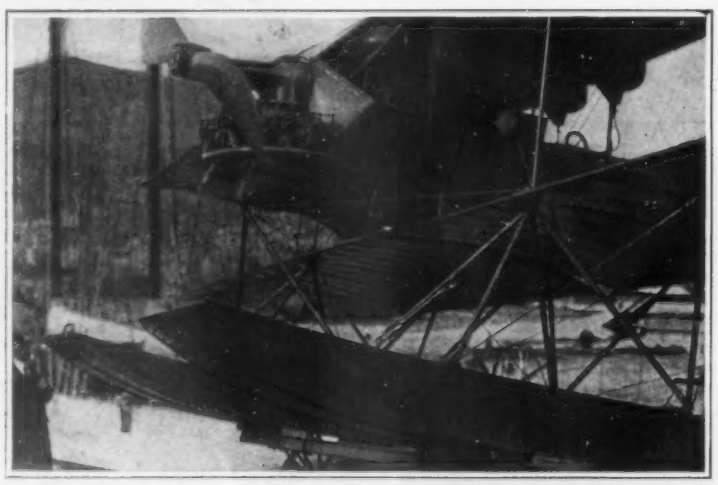
Rear view of Borel flying boat.
Note peculiar floats on ends of triangular wings forming lower plane of this biplane. Also elevator hanging down over vertical rudder.



Fischer's Henry Farman biplane at rest.
Note the sharp angle at which the machine is placed; also cylindrical floats at rear.



Breguet biplane with 200 horse-power Salmson motor.
In addition to the single main float, there are two smaller boat-shaped floats, one on either side.



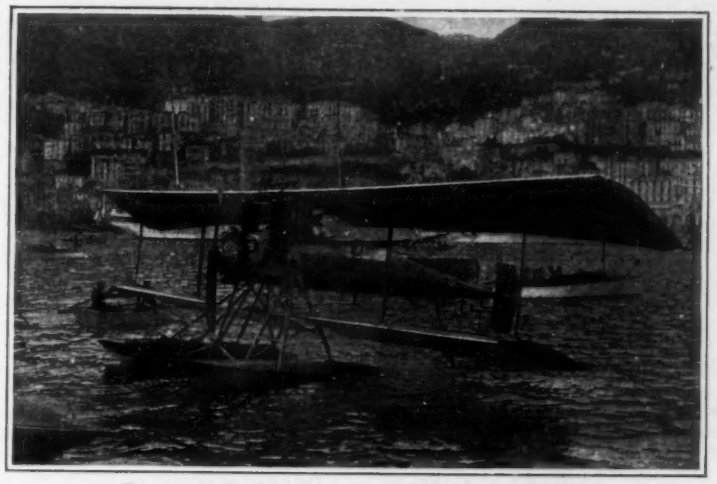
Astra biplane, showing floats and novel Salmson motor.
The motor of the Canton Unné system has circularly arranged, horizontally-placed cylinders and drives the propeller through bevel gears.

floats are used, these are generally flat on the bottom after the manner of the Curtiss. Most of the floats are flat, scow-shaped affairs, though some of them are more or less pointed and rounded off on top. As a rule, they are made of wood or of veneer, but when cylindrical floats are used, these of course are of metal. The floats used on the Nieuport monoplane have little wings on each side for the purpose of stopping the float from diving and drawing the machine under in a sea.

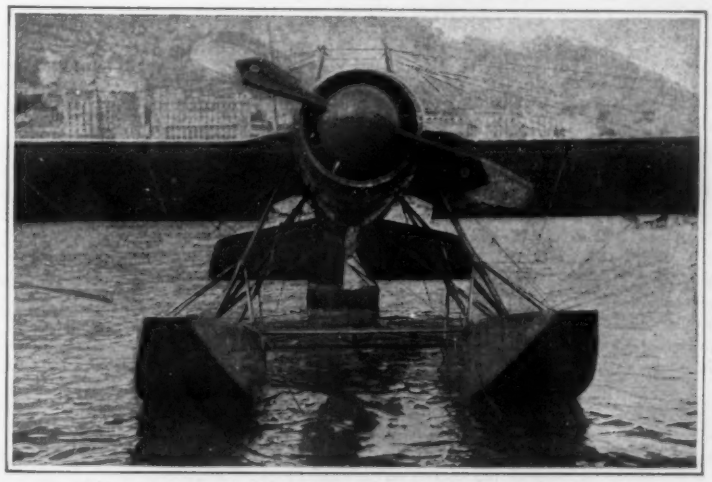
There were a number of flying boats on the order of those originated by Curtiss and Donnet-Levêque. One of these, the Borel, we illustrate. This is in reality a monoplane, although it is intended to be a biplane and is really in the biplane class on account of the small fins, one on each side of the boat, that represent the lower plane. These fins each have rather clumsy, rectangular, fish-shaped floats beneath their outer tips. The men occupy a position side by side in the front part of the body of the machine, which forms the boat, while the Gnome motor is placed above at the rear edge in a notch in the plane.

Curtiss is at the present time building a new form of flying boat for Mr. Harold McCormick of Chicago, in which the motor is placed forward of the two planes and about half way between them, while the boat is beneath the planes and the passengers occupy a position about on a line with the rear edge of the planes, but beneath them. This seems an excellent design, as in case of a plunge into the water, the motor would be unable to fall upon the occupants or in any way trouble them. The placing of the motor in the boat well forward would also seem to be a good location.

The Monaco meet has demonstrated the safety of the hydro-aeroplane and the usefulness of the flying boat, and without doubt such craft will increase and multiply very largely both here and abroad during the coming summer.



Breguet hydro-biplane with vertical Salmson motor.
Note the neat floats at ends of lower plane. The one beneath the tail is hidden, but the struts supporting it are visible.



Front of Prevost's Deperdussin with 160 horse-power Gnome.
The three floats are clearly seen. Note the hemispherical wind shield on motor to reduce air resistance. The body has a streamline form.

General view of the hydro-aeroplane "port" at Monaco.

Artificial Limbs: Ancient and Modern

By Arthur H. J. Keane

MAN is undoubtedly the superior of the Animal in many ways, but it cannot be concealed that, in some things, animals have considerable advantages which we may well regard with envious eyes. Take the crab and the lobster (to mention but a couple by way of example) for instance; should one of these creatures lose a limb as the result of accident, attack or strife, kindly nature at once sets to work to supply the individual with a fresh member, quite as good if not better than its predecessor.

Man, on the contrary, has to rely upon his wits to make good those losses which result from his wars, street accidents, railway collisions and other *dei ex machina* to which he is exposed at any minute. Many of the marvelous artificial aids now obtainable are regarded as essential products of modern times, but, as a matter of fact, appliances of this kind are by no means modern. In the museum of the Royal College of Surgeons, Lincoln's Inn Fields, London, there is an artificial leg, made about 300 B. C., of bronze, wood and iron. Again, who has not heard of the famous "Iron Hand" made in Nuremberg, Germany, in 1504, for the German knight, Götz von Berlichingen? Among the old-time Indians, ears, noses and lips of plaster were quite common, one of their ordinary punishments being to cut off these useful parts of the human anatomy. Greek and Roman veterans who had lost a leg or an arm in the wars used to replace them by very capable substitutes, and Plinius speaks of a Roman soldier who (about 150 years B. C.) was famous for his wooden hand with which he was still able to fight as an able swordsman. In 1604 the Duke of Brunswick had to use an artificial hand.

Artificial limbs with movable joints were also largely made by the famous Ambroise Paré (1517 to 1590), the celebrated French surgeon known as "The Father of French Surgery." He was surgeon to Henry II. (1552), and also to Francis II., Charles IX. and Henry III. He substituted the ligature of arteries in the treatment of gunshot wounds which, previously, had to be cauterized with boiling oil. Later on Father Sebastin, a Carmelite monk, was renowned for the manufacture of movable arms and hands. About the middle of the seventeenth century Falcinelli, a Florentine surgeon, mentions artificial eyes of gold, silver and crystal painted in different colors; he also describes gold and silver ears which were either tied to the head with strings, or else sewn on the skin of the scalp by the aid of gold and silver wire. Silver noses are spoken of also as having been in use for a long time.

Artificial arms, legs and hands are fairly well known and need but little description. Of the more-concealed members we may mention artificial feet, which vary considerably in construction, material and price. After what is known as a Hey's or a Chopart's operation (leaving the heel and a part of the sole of the foot), the main idea is to make a presentable appearance with a cork-filled boot. In cases of higher amputation, where an artificial ankle-joint is needed, it may take the form of a transverse rod working in a socket, or of two "rule joints," one on either side of the stump; the lateral yielding of a foot is sometimes imitated by side springs which yield to lateral pressure. One of the best substitutes for the real foot is a curved sole (Beaufort), where the movement has a natural appearance, though the substitute itself is somewhat unsightly. The simplest form of artificial foot is a peg at the end of a "bucket" which holds the stump. The center of the artificial ankle is often on the ball and socket joint principle. The artificial foot is sometimes extended by means of catgut strings fastened at the back of the knee, with flexible bands passing down over the upper surface of the foot. In Syme's operation (amputation below the knee), pressure can be borne on the extremity of the stump, and the foot can be made to suit the purse and occupation of the patient: in amputations above the knee the weight can be borne either on the extremity or by a leather sheath. The simplest form of artificial hand is a leather sheath laced to the arm stump, and so fitted that a knife, fork or spoon can be screwed into it. Other hands open and close by hydraulic pressure; the Beaufort hand is of wood with a moveable thumb. Prices of artificial limbs vary greatly; for instance an ordinary "box-leg," on which the cripple kneels with the stump pointing to the rear, can be had for about fifteen shillings, while a jointed mechanical leg may run up to as much as fifty guineas.

One of the greatest triumphs ever reported in this curious industry, however, is undoubtedly the mechanical face worn by a man whom Dr. Delair (a French doctor) exhibited recently to the members of the French Medical Academy. Owing to the accidental discharge of a fowling-piece the whole lower portion of this man's face was destroyed, and a portion of the tongue seriously damaged, but by a marvelous piece of mechanism the patient has had his appearance restored to him. The mechanism consists of four parts; in the first place, of a silver grooved case, in which the lower row of artificial teeth are fixed, attached to a tin device containing the upper teeth; there is also a second part of indurated rubber and gold to hold the upper front teeth, the whole terminating in two small horn-like pegs, shaped so as to hook into the nostrils. The third part consists of the chin and lower lip, which are made of special soft rubber painted in flesh tint, in a most deceptive manner. The chin is also covered by a false beard. At the back of this portion there are several small screws which pass through holes in the tooth holders, and thus join the chin and lip to the artificial upper jaw and palate. The fourth and last piece is the upper lip and nose, also made of flesh-tinted soft rubber and covered with a false moustache. Thanks to this skillful contrivance the man is able to speak and chew his food, while at a short distance it is impossible to discern that his face is not natural. The different parts have to be unscrewed once a day, and well washed with water and soap.

It is to be hoped, now that airships are in the air, some good genius will discover an artificial skull capable of withstanding bombs and shot dropped from the clouds.

A New Solvent for Compressed Acetylene

THE tank of compressed acetylene carried by autos for their lamps is safe enough because the gas is dissolved, under presure, in acetone. An attempt to compress the pure gas would result in an explosion, immediate or delayed, but violent. The search for a substitute for acetone has resulted in the recommendation that acetaldehyde be used. It is cheap and will become cheaper, as it is made by the partial oxidation of grain alcohol, but it possesses other advantages.

In industrial practice eighty-five ounces of acetone dissolves, as a rule, thirty-seven ounces of acetylene at 70 deg. Fahr. and two hundred and fifty pounds pressure, while eighty-two ounces of acetaldehyde have dissolved forty-eight ounces of acetylene at 70 deg. Fahr. and two hundred and sixty-five pounds. It is evident that acetaldehyde is the better solvent. It burns with a heat nearly as great as that of acetylene itself, and so in metal cutting or welding by the oxy-acetylene blowpipe it cools the flame very little. With acetone there is only an hour's warning before the gas gives out, but acetaldehyde develops a round, black spot in the flame five or six hours before exhaustion of the gas.

The Heavens in May

Motions of the So-called "Fixed" Stars

By Henry Norris Russell, Ph.D.

AS we look out upon the constellations, which after a brief acquaintance become so familiar to us, we may be from year to year impressed with the utter absence of change in their outline. More exact study of the motions of the stars which compose them only deepens this impression, for we learn that no changes which would be at all conspicuous to the unaided eye have taken place in the appearance of any one of the star-groups in our skies in the last three thousand years. But when we accustom our minds to a different time-scale, measuring the intervals between our imagined observations, not in years, or even centuries, but in hundreds of thousands of years, we come upon quite a different state of things.

It may seem bold to attempt to forecast at all what the heavens will look like a hundred thousand years from our era; but for the brighter stars their apparent motions have been so carefully observed that, if they continued to move over the heavens at the same apparent rate, their positions, even at that very remote epoch, could be foretold accurately enough to make a very fair star-map for naked-eye purposes (though many stars might be a degree or so out of place on it).

But for such long intervals of time we cannot safely assume that the apparent motions of the stars in the sky will be uniform. The stars are actually moving in straight lines at uniform speed. But from this very fact it is evident that any star must seem to us to move fastest in the sky when it is nearest us, and slower when it is in other portions of its track (both because it is then farther away and because its motion then makes an oblique angle with our line of sight instead of a right angle).

If a star is coming nearer to our system, it should therefore appear to move over the celestial sphere with gradually increasing speed; and the opposite will be true if it is receding from us. This change in speed will be very slow, and will not become perceptible, even to the most refined observations, until the star has moved over ten or fifteen minutes of arc. So far it has been detected by direct observation for only two stars of very large proper motion—Groombridge, 1830, and 61 Cygni. For both of these Prof. Boss finds that the apparent motion is gradually increasing in rapidity, from which it follows that these stars must be coming nearer our system, a result fully confirmed by direct spectroscopic observations.

For many other stars, however, we may predict with confidence that similar changes in their "proper motions" will occur. If we know the parallax, i. e., the distance of a star, and have also measured with the spectroscope its velocity of approach or recession, we can easily make a diagram of its real path in space (using the sun as the center of reference) and thus predict all the circumstances of its motion.

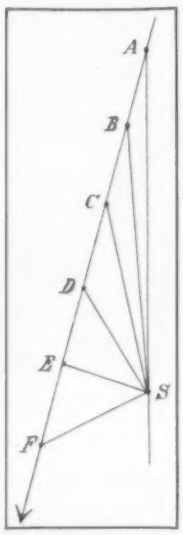
For an example, we may take the star Zeta Herculis. The observed parallax of this star, 0.14 second, shows that its present distance from us is about 1,400,000 times that of the sun. It appears to move across the sky at a rate of 0.61 second a year, which, at that distance, demands a real motion, at right angles to our line of sight, of 12½ miles a second. But, from the spectroscopic work of several observers, it is found that it is approaching us at the unusually rapid rate of 47 miles per second. It follows that this star is actually moving at a rate of 49 miles a second, in a line which makes an angle of only 15 degrees with the line joining it to the sun. At this rate it travels every year a distance equal to 16½ times that separating the earth from the sun.

We can now make a diagram of the track of this star past the sun, such as is shown in the adjacent figure, in which *S* denotes the sun, *A* the present position of the star, and *B*, *C*, *D*, *E*, *F*, its future positions at intervals of 20,000 years.

A mere glance shows how much more rapidly this star will appear to be moving when it is nearest us (some 85,000 years hence) than it does now.

More detailed computation shows that at that time it will appear as bright as Arcturus does now, and have a "proper motion" of more than 9 seconds per year—greater than any star has at present. It will certainly be a remarkable object then, but can hardly retain its present name Zeta *Herculis*, for it will have moved northward and westward about 75 degrees into a region of the sky which is now assigned to the southern part of Ursa Major; and 100,000 years hence it will be in Leo.

This is a somewhat exceptional case, for the track of this star comes remarkably near the sun, and its motion is very rapid.



Path of Zeta Herculis for 100,000 years.

But a majority of the stars now familiar to us will have got far away from their present stations by the end of a thousand centuries.

Arcturus, for example, which is now almost at the nearest point of its path, will then be although 2,750,000 times as far away again as us as the sun, about half as far away again and appear most half as bright as now, while it will have moved some 49 degrees southward into the heavens in the region now occupied by Corvus. Spica, on the other hand, is a very remote and slowly moving star, and will in all that time have moved but 1½ degrees southwest of its present position. Antares, and most of its brilliant neighbors in Scorpio, are even more remote, and will change their places by only a degree or so in all this time. Altair, on the contrary, is a near neighbor, and is still approaching us, so that in the year 101,900 it will be within the present boundaries of Hercules, more than twice as near, and fully five times as bright as at present.

All this may seem like very long range speculation; but a hundred thousand years, however long historically, is but a very short time from the standpoint of geology, as all students of that science agree. It is, therefore, much more than probable that could we be transported back to but a relatively recent geological period, say half a million years ago, we would find, on regarding the heavens, little or nothing recognizable in the way of constellations or individual stars (except a few groups like the Pleiades). But, at this time, the main features of the present land surface of the continent were not greatly different from what they are now, and so we see that the "eternal hills," perishable though they may be, are in all likelihood more lasting than the constellations, though very far from being as enduring as the stars.

The Heavens.

Turning to our map, we find upon it all the stars of which we have spoken. Arcturus is high in the south, seeming at first glance almost overhead. Spica is lower down, and to the right, and Scorpio is rising in the southeast. Hercules, with Corona above and Lyra below him, is east of the zenith, and Aquila, with its bright star Altair, has just risen. Ophiuchus and Serpens fill the southeastern sky. Centaurus is low in the south, and Hydra in the southwest, with Leo, Virgo, Crater, and Corvus above it. Gemini and Auriga are setting in the west and northwest, and the Great Bear hangs high above them. Ursa Minor and Draco are above the pole, Cepheus and Cassiopeia low in the north, and Cygnus in the northeast.

The Planets.

Mercury is a morning star all through May, but is best observable at the beginning of the month, when he rises about 4:30 A. M. Being, however, south of the sun, he is not very favorably placed for us. Venus, having passed through conjunction with the sun on April 24th, is now a morning star, and rapidly moves out of the twilight. At the end of the month she reaches her greatest brilliancy, being about 11 times as bright as Sirius, and 120 times as bright as a standard first magnitude star. She rises about 3 A. M., and can be followed with the unaided eye long after the sun has risen.

Mars is likewise a morning star, in Pisces, rising about 3 A. M. in the middle of the month.

Jupiter is in Sagittarius, and rises about 11 P. M. on the 15th. He is too far south to be well observable until some time after midnight.

Saturn is evening star at the beginning of the month, setting at 8:45 P. M.; but the sun overtakes him, and on the 28th the two bodies are in conjunction, and the planet unobservable.

Uranus is in Capricornus, observable in the hours before daybreak. Neptune is in Gemini, and is about four hours high at sunset.

The moon is new at 3 A. M. on the 6th, in her first quarter at 7 A. M. on the 13th, full at 2 A. M. on the 20th, and in her last quarter at 7 P. M. on the 27th. She is nearest the earth on the 15th, and remotest on the 28th. During the month she passes by Mars on the 2nd, Mercury and Venus on the 4th, Saturn on the 7th, Neptune on the 11th, Jupiter on the 23rd, Uranus on the 25th, and Mars again on the 31st.

Princeton University Observatory.

At 11 o'clock: May 7.
At 10½ o'clock: May 15.
At 10 o'clock: May 22.

At 9½ o'clock: May 30.

At 9 o'clock: June 7.
At 8½ o'clock: June 14.
At 8 o'clock: June 22.

NIGHT SKY: MAY AND JUNE

Water Softening Methods

METHODS of water softening are not only of great practical value for preventing boiler scale, but are needed in dyeing, laundry and other branches of industry, as is well known. We wish to speak of the use of aluminium for this purpose. A European method consists in filtering the water upon the compound called "permutite," which is a double silicate of alumina and soda obtained by an industrial process. Contact with it causes the lime of the water to give soluble salts of soda by double decomposition, and the filtering matter is transformed to lime salt, this being renewed by a common salt treatment. Still more interesting is the new process which consists in allowing the water which is to be used in boilers to flow over a simple aluminium plate with embossed surface. It is said that such water will no longer give boiler scale, and it will even loosen up the scale already in the boiler. Such water should be used soon after the treatment or be kept in tanks painted inside. It is not known just what changes take place in the water, and perhaps the dissolved substances become ionized. As it is seen to be less oxidizing in its nature, no doubt the water has dissolved a certain amount of aluminium, which metal absorbs most of the dissolved oxygen, hence the lack of oxidizing power of the water.

This picture shows a portion of the big battery of Packard trucks which plunged into the relief work of flood swept Dayton

THESE PACKARD TRUCKS HELPED TO PUT DAYTON BACK ON THE MAP

Following the Dayton flood, thirty-eight Packard trucks were used twenty-four hours a day to carry relief supplies and clean up the town

THE Citizens Relief Committee issued the call for help at noon March 29. Two hours later, eight Packard Trucks were loaded onto a special relief train at the Packard factory. Within twenty-four hours, these trucks were at work in Dayton. Ten other Packard trucks were sent by special train from Cincinnati. These vehicles, with the large battery of Packards owned by the National Cash Register Company, formed the backbone of the transportation outfit used in relief service.

Dayton streets were choked with wreckage and debris. With all other methods of transportation rendered useless, necessity demanded motor trucks and they made a magnificent response.

The Packard trucks worked in water so deep that it was necessary to cover the radiators to avoid flooding the engines. In the stress of continuous emergency work, the trucks received no mechanical attention. It was a situation that called for 100 per cent efficiency and the Packards met this demand.

Sixteen hundred dead horses and many carcasses of other animals were removed by the Packard trucks within a period of three days. United States army officers say this prompt work averted an epidemic. Members of Dayton's Relief Committee state that the Packard trucks were a big factor in making the city fit for habitation.

The people of Dayton know that when necessity calls the Packard delivers. What will you do when your test comes?

HEADQUARTERS
DAYTON MILITARY DISTRICT
DAYTON, OHIO

Dayton, Ohio, April 17, 1913.

Packard Motor Car Co.,
Detroit, Mich.

Gentlemen:

We are both pleased and grateful to report that during the past three weeks of most extraordinary service, Packard trucks have rendered invaluable and continuous service. The work has been continuous day and night over almost impassable streets.

Without motor trucks it would have been impossible to have distributed relief supplies.

Very truly yours,

Adjutant General.

THE NATIONAL CASH REGISTER COMPANY

OFFICE AND FACTORY, DAYTON, OHIO
BRANCH FACTORIES: LONDON, ENGLAND; BERLIN, GERMANY
TORONTO, CANADA

DAYTON, OHIO, April 9, 1913.

Mr. Alvan Macauley,
General Manager, Packard Motor Car Co.,
Detroit, Mich.

Dear Mr. Macauley:

Your letter of April 2nd is received, and I take the earliest opportunity of writing to thank you on behalf of the Dayton Citizens' Relief Committee, for the excellent assistance rendered by the Packard Motor Car Co., in our time of stress.

At the time we appealed to you, motor trucks were our most pressing need, as we had the greatest difficulty in getting provisions for hungry people to the different points in the city for distribution. Your promptness helped to save the situation.

Sincerely yours,

Ask the man who owns one

Packard Motor Trucks are in successful use in 169 lines of trade

PACKARD MOTOR CAR COMPANY, DETROIT

King of A

THE LIFE BOAT

THE FIRE ESCAPE

Weed
ANTI-SKID
Chains

THE PULMO

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On the Front W

All Safety Devices

The Important Factor of Automobile Safety

All danger of skidding now eliminated. No longer a bugaboo to the motorist who takes the ordinary precaution of always carrying Weed Chains with him and putting them on when the roads and pavements are wet, slippery or greasy.

Many ships have gone to the bottom—hence the necessity for "Life Preservers." Elevators have fallen time and time again so "Safety Dogs" are required. Fires have oft precluded escape by the regular exits and "Fire Escapes" are compulsory. And last *but not least*, is the danger from the ***SKIDDING*** of an automobile that is quite as much of a terror to the experienced driver as it is to the novice.

To remind you of loss of life in connection with motoring is unpleasant, but if you have ever had a *narrow escape from a bad skid* you will agree that there are graver annoyances than this reminder. *There is only one way* by which skidding can be guarded against and absolutely prevented—and that is by the use of

Weed Anti-Skid Chains

REAL LIFE INSURANCE—the kind that saves lives

Probably no other device has done so much to raise the factor of automobile safety as WEED CHAINS. They are the proverbial "ounce of prevention" against skidding—the cause of over nine-tenths of all automobile accidents. *Life Insurance Companies* recommend their use to their policy holders. *Accident Companies* go so far as to strongly endorse and recommend them. *Taxicab Companies*, for their own protection, *insist* that their drivers put them on when the streets are wet or icy.

Perfect Control and Safe Comfortable Driving

through deep mud, treacherous sand or on slippery pavements can be had only by equipping all four wheels of your car with Weed Chains.

On the Rear Wheels—they insure traction and prevent skidding.
On the Front Wheels—they make steering easy and sure.

WEED CHAINS cannot injure tires because they creep—are easily put on in a jiffy without a jack or other tool.

If you haven't a set of WEED CHAINS or *if you have* a pair for the rear wheels only, get a full equipment now. Delay is dangerous. Stop in at your dealer and provide yourself with the kind of ***Life Insurance that saves lives.***

Weed Chain Tire Grip Co., New York

Manufactured in Canada by
DOMINION CHAIN CO., Limited—137 McGill Street, Montreal, Can.

The Smallest Automobile

AN automobile which is probably the most diminutive practical working car in existence is illustrated in the accompanying photographs. It was designed and built by Joseph Newman of London, and the little toy is driven and controlled entirely by his little son, Freddy, five years old, who takes his little sister and brother for rides in it. Mr. Newman built the car with his own hands. It took eighteen months to complete the work. The car is equipped with a two-cylinder gasoline engine of 2¼-inch bore, and the engine is air-cooled with a fan. The power is transmitted by chain and belt to the rear axle. The starting gear consists of a foot lever which moves the belt from an idler to an active pulley. The mechanism is so constructed that when the youthful chauffeur takes his foot off the pedal, the belt is moved to the idler and the brakes are applied. The car is equipped with electric lights supplied from a 4-volt accumulator. The miniature automobile is fitted with an exhaust whistle, and is in every way the exact counterpart of larger automobiles. It will be observed that the car is provided with a top which may be brought forward when the weather is inclement.

Just like grown folks.

Underside of the baby auto.

A Black Walnut Burl

WEBSTER defines the word *burl* as "an overgrown knot, or excrescence, on a tree." These gnarled and warty excrescences, known also as burrs, are malformations of a considerable interest to the cabinet and furniture makers. On a recent visit to Mt. Vernon, Virginia, the writer photographed a remarkable excrescence on a walnut tree, which is located just about 50 feet in front of Washington's tomb. By comparing the diameter of the trunk, which is 15 inches four feet above the ground, with that of the burl, it is seen that this is no small specimen of a burl. Though sometimes found larger, they rarely occur so high up on the branches and attain such an enormous size as this one. Most of them are on the main trunk of the trees and occupy a space equal to one half the diameter of the tree. This peculiar growth is sometimes caused by a fungus, which attacks the cambium or growing tissue and results in an abnormal development. The walnut tree is frequently attacked by this fungus, and some specimens may be found with a number of burls. It may also be due to some mechanical injury to the cortex, or at other times to the sudden exposure of a previously shaded tree to the light, as in the case where neighboring trees are removed. From this peculiar growth is obtained the most beautiful grained wood for cabinet work. Although the wood is more difficult to work, yet the beautiful variegated colors, bird's eye markings, and graceful wavy grain far surpass those of any other wood in intricate design and color.

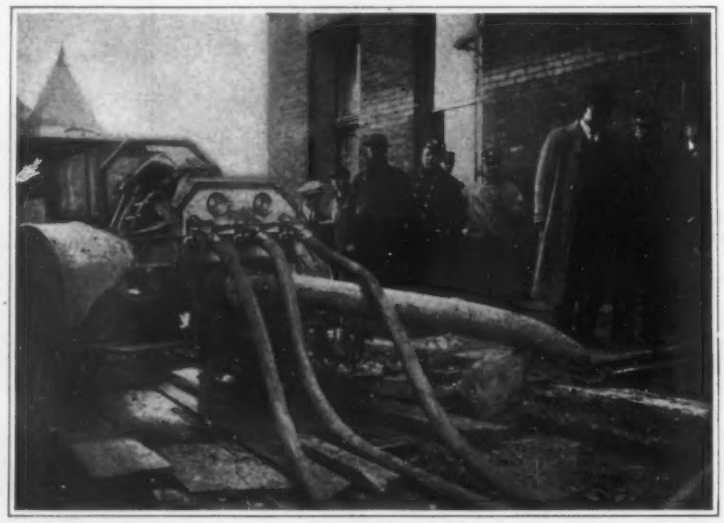
Immense burl on a walnut tree.

Sawing down a tree single handed.

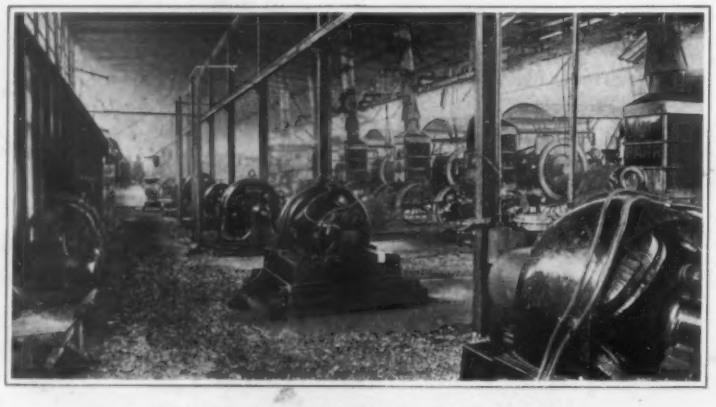
Pumping Out Flooded Cellars With a Motor Fire Engine.

AFTER the recent Ohio floods subsided, even though the surface was drained of water, there yet remained considerable work to be done in pumping out cellars. For this purpose, wherever possible, fire engines were used. The accompanying photograph shows a gasoline pumping engine at work at Columbus, Ohio, drawing water out of the cellar of engine house No. 10. This sort of work put the fire pump to a severe test, for the water was muddy and sandy. However, the pump shown in the illustration is of the multiple stage centrifugal type and was in no way injured by the grit sucked in with the water. The pump could draw in stones as large as three quarters of an inch in diameter without injury to any of its parts. The pump is driven by a six-cylinder engine of 144 horse-power capacity, and it will deliver 1,000 gallons per minute at 120 pounds of pressure. At a recent test, it drew water six and one half feet, pumping 1,239 gallons per minute, at 120 pounds pump pressure through three lines of 2½-inch hose, 100 feet in length, with a 1¼-inch smooth bore nozzle on each line. The test lasted twenty minutes. The engine makes 750 revolutions per minute and it drives the pump at 1,500 revolutions per minute.

A six-ton truck hauling a twenty-three-ton boiler.



Pumping out a flooded cellar with a motor fire engine.



Utilizing power developed by testing tractors.

Guide for a Lumberman's Saw

IN order to enable a lumberman to use a two-handled saw without the aid of a second man, a Canadian has devised the guide shown in the accompanying illustration. A pair of tongs are provided which may be clamped to the tree, the jaws of the tongs being formed with teeth adapted to dig into the bark of the tree. The handles of the tongs pass through sockets formed in a guide bar to which they are made fast by means of a pair of thumb screws. The saw rests on a carriage that is adapted to travel along the guide bar as the saw is fed into the wood. A constant tension is provided by a weight on the end of a chain that passes over a pulley at one end of the guide bar and is attached to the carriage. With this arrangement the lumberman operates the saw from one end while the other is supported by and is free to slide in the carriage. A twenty ounce weight or, if preferred, a heavy clock spring is sufficient to feed the saw into the tree. With this arrangement a man may corner or notch a tree and can use wedges. A tree of any size may thus be cut down single handed.

Hauling Forty-five Tons With a Six-Ton Truck

IN the earlier days of motor trucking, a truck capable of carrying its load with a reasonable degree of reliability and economy was thought to be doing very well indeed, and nothing better was asked of it. While even to-day there are motor trucks that are rather hard pressed to fulfill these conditions, it may be said that the majority of machines are capable of doing a little better than might be expected from the normal rating. A case in point is that of a six-ton truck with hydraulic transmission of power, which recently made a very heavy haul with success. The accompanying illustration shows the truck and its trailer for the time being—a huge contractor's truck weighing, without load, 12½ tons and loaded with a boiler weighing 23 tons, the total trailer load being 35½ tons. The motor truck, weighing 3½ tons, was loaded with 6 tons of boiler fittings, etc., and the entire weight of 45 tons was moved up-town through the streets of New York, from Nineteenth Street to Sixty-eighth Street, at the rate of about 4 miles an hour, without difficulty either in handling the great weight or in controlling the machine and the trailer. Several grades, severe when the load is considered, were negotiated. In order to handle this piece of work in the usual way about twenty horses would have been required, making a very long, awkward procession and blocking cross-street traffic considerably. The time in transit would have been several times greater than was taken by the machine and the damage to the pavement would have been greater owing to the slower speed and, consequently, the longer time the crushing weight would have been on the road.

Obtaining Power from a Testing Plant

THE manufacturer of engines of any type, in the nature of the case, makes a thorough test of each one before it goes to the user. This is especially true of gas engines of any sort. Parts must be "smoothed up" and numerous adjustments made. The various devices such as magnetos, coils and oilers must be tested under hard service conditions. If the test is made directly on the Prony or water brake all the fuel is lost. Realizing this, an enterprising company manufacturing tractors, has used its machines

(Concluded on page 421)

The new Garford "Six" was designed contrary to the usual custom. Instead of utilizing, re-designing or substituting any old parts, this car is new in its entire construction.

From the smallest steel bolt to the handsome, graceful and noiseless one-piece-all-steel body, it is a distinct 1913 creation.

In it are embodied more new and practical six-cylinder improvements and conveniences than in any other "Six" built.

As one illustration, your attention is directed to the single, parabolic electric headlight, sunk flush with the radiator. This new method of lighting eliminates the rattling, cumbersome and unsightly headlights that were always in the way. It gives the car a much cleaner and much more finished appearance.

And this is but one of the many exclusive Garford features.

A Garford owner recently wrote: "It strikes me that in the new Garford 'Six' you started your improvements from where all the others left off."

So, if you are in the market for a "Six," we believe we can offer you even more for $2750 than most other manufacturers can for double that price.

Literature on request.

Electric Starter, which never fails to start instantly—winter or summer.

All lights are electric.

Big, single electric parabolic headlight, sunk flush with the radiator.

Electric horn.

One piece, all steel body, steel Pullman car construction—no joints, no rivets, no wood.

Warner Auto-Meter driven from the transmission.

60 horsepower, long-stroke motor—3¾ in. by 6 in.

Wheel Base, 128 inches.

Tires, 36 x 4½.

Demountable Rims.

Center Control.

Left Hand Drive.

Three Speed Transmission.

Full Floating Rear Axle.

Bosch Magneto.

Equipment — everything complete from tools to top.

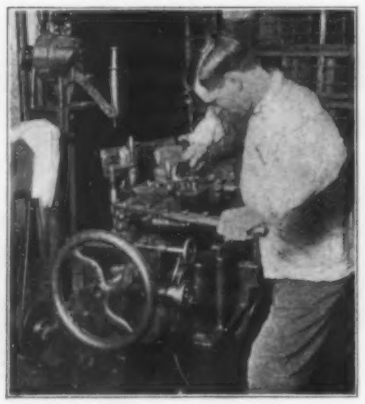
The Garford Company, Dept. 21, Elyria, Ohio

The Shoes You Wear

Why They are Moderate in Price and Good in Quality

By George Brockholst

The Goodyear welter, which has been the leading factor in revolutionizing shoemaking and which has done much to reduce the price of shoes.



This lasting machine is provided with wipers for toe and heel, which draw the leather from all directions so that no wrinkles show on the shoe.

A rounding and channeling machine is employed in cutting the outsole to conform with the shape of the bottom of the last with any desired extensions.

Goodyear improved sole-laying machine, which fastens the cemented soles to the shoe-bottom without tacks so as to leave a clean bottom.

The first fact that everyone should know about shoes is this:

SHOES ARE BETTER IN QUALITY NOW THAN THEY EVER WERE AND VERY NEARLY AS CHEAP. Every other necessity of life has increased much more in cost.

Another fact:

SHOES ARE NOT MADE BY A TRUST. No less than 1,200 factories are keenly competing with one another.

There must be some reason why shoes have not increased very much in price and why there is no shoe trust.

There is just one and only one reason and that is: THE EFFECTIVE SERVICE POLICY OF THE UNITED SHOE MACHINERY COMPANY.

HOW THE UNITED SHOE MACHINERY COMPANY WAS STARTED.

The United Shoe Machinery Company was organized in 1899. It was formed for the purpose of enabling shoe manufacturers *to make better shoes* than they made before and *to sell them to the public at the smallest possible expense.*

Before the United Shoe Machinery Company was organized, three important companies were supplying manufacturers with shoe machinery. THE COMPANIES WERE NOT COMPETITORS, because each made a class of machines for a special purpose.

Thus, the Goodyear Shoe Machinery Company made machines which produced what are known as "welt" shoes, like those once sewn by hand. In sewing a shoe by hand, a thin and narrow strip of leather called a "welt" is first stitched to the insole and upper. The heavy outsole is then sewed to this welt, so that the stitches fall outside and do not touch the foot, the insole being left entirely smooth. The welting and stitching machines of the Goodyear Company—named after Charles Goodyear, who developed the original invention and who was a son of the inventor of the Goodyear rubber-vulcanizing process—completely displaced hand sewing. The welt shoe made on the Goodyear machines is the most comfortable shoe sold to-day—the finest product of the American shoe industry.

Besides the Goodyear Shoe Machinery Company, there were in the field the Consolidated and McKay Lasting Machine Company and the McKay Shoe Machinery Company. The Consolidated and McKay Lasting Machine Company made machines for lasting a shoe, a totally different operation from that performed by the Goodyear machines. The McKay Shoe Machinery Company made machines for attaching soles and heels by metallic fasteners.

These three companies did not sell their machines to shoe manufacturers, but leased them and charged a royalty for their use. So long as the machines were in use they earned money for their manufacturers and for shoe makers. It was very necessary that they should not remain idle for a long time. Hence each of these companies established a repair service to keep its leased machines in good running order.

Here were three NON-COMPETING companies dealing with the same shoe manufacturers and sending out three sets of repair men to the same factories. Clearly, there was an unnecessary duplication of expense, for all of which the shoe manufacturer and *ultimately the public paid.* One set of repair men could easily keep all the machines of the three companies in order. One factory could easily make all three NON-COMPETING types of machines, so that the shoe manufacturer could obtain his equipment from one source, just as housewives can obtain non-competing carpet sweepers and gloves or non-competing washboards and linen from a single department store.

This reproduction of an ancient decoration shows that, thousands of years ago, the Egyptian made shoes very much as the modern cobbler did before the invention of American shoe machinery.

From Dooley's "Manual of Shoemaking" by courtesy of Little, Brown & Co.

An interval of thousands of years separates this picture from the Egyptian hieroglyphics above. Yet the method of shoemaking disclosed is the same. More progress has been made in the last generation, because of the systematic development of machinery in this country, than in the preceding fifty centuries.

So, in order to lessen the expense of making shoes AND IN ORDER TO ENABLE THE PUBLIC TO BUY THE BEST SHOES AT THE LOWEST PRICE the three NON-COMPETING firms mentioned were consolidated in 1899 to form the United Shoe Machinery Company.

THE BENEFITS OF THE LEASING SYSTEM.

Because the old leasing system has been continued by the United Shoe Machinery Company, *there is no shoe trust.* You will understand why if you consider the way most manufacturers must start in business.

Suppose that you had decided to engage in a manufacturing enterprise. You would have to raise money not only for the purpose of acquiring a factory, but also of purchasing machinery. Indeed, you would spend much money on machinery—so much that when you sold your goods, you would have to make a proportional charge for the interest on the money invested in the machinery—about six per cent a year—and another ten per cent a year for depreciation, repairs and the like. Because these fixed charges are large, because it takes much mony to buy expensive machinery, *many important industries*—textile manufacturing, for example—*are concentrated in the hands of a few companies.* COMPETITION IS LIMITED.

This applies to nearly every industry EXCEPT SHOE MANUFACTURING. The United Shoe Machinery Company's leasing method renders it possible to obtain the most modern equipment for a small outlay, so that the manufacturer can use his money over and over again in buying raw material and selling shoes. *He does not have to make a charge for interest on money invested in shoe machinery or for the depreciation of the machinery.*

THAT IS ONE OF THE CHIEF REASONS WHY YOUR SHOES ARE SO CHEAP. THAT IS ONE OF THE CHIEF REASONS WHY THERE IS NO SHOE TRUST.

THE SHOE MANUFACTURER PAYS ONLY FOR THE WORK THE MACHINE DOES, just as he pays only for the work that a man does.

WHY THERE IS NO SHOE TRUST.

THE UNITED SHOE MACHINERY COMPANY DEALS WITH ALL SHOE MANUFACTURERS ALIKE. It matters not whether a man has a capital of a million dollars or only ten thousand dollars.

Big shoe manufacturers have tried to obtain what they call "better terms" from the United Shoe Machinery Company, because they use so much more machinery than the small manufacturer. If the United Shoe Machinery Company had listened to this argument there would be only a few large factories engaged in shoe manufacturing to-day, AND NO SMALL FACTORIES. *As it is, the man with only a few thousand dollars capital is able to compete with the millionaire.*

THAT IS ANOTHER REASON WHY THERE IS NO SHOE TRUST.

ONE AND ONE-THIRD CENTS A PAIR.

Of the three hundred machines made and installed by the United Shoe Machinery Company, more are sold outright than are leased. But in order to use their money in making shoes, most shoe manufacturers prefer to lease machines when they can.

Here is a table of royalties per pair paid by shoe manufacturers who lease machines:

Goodyear welts, men's work	$0.05694
Goodyear welts, women's work	0.04694
Goodyear turn shoes, women's and misses'	0.005
Men's and women's McKay shoes	0.01746
Children's McKay sewed shoes	0.01391

The average royalty received, based on the foregoing table, is about two and two thirds cents per pair. In reality IT IS LESS THAN EVEN ONE AND ONE THIRD CENTS A PAIR for most of the shoes worn, because Goodyear welt shoes constitute less than one third the annual production of the United States.

SINCE THE ORGANIZATION OF THE COMPANY THE SAVING IN COST OF PRODUCTION OF MEN'S GOODYEAR WELT SHOES EFFECTED BY NEW AND IMPROVED MACHINES AND LOWER ROYALTIES HAS BEEN NEARLY 9 CENTS, OR NEARLY DOUBLE THE TOTAL ROYALTY NOW PAID.

In return for this trifling royalty, the United Shoe Machinery Company provides American shoe manufacturers with *a service that is unrivaled and unique.* This service means the assumption of the whole cost of invention, experimental work, development, manufacture and depreciation of machines; the cost of ceaseless care of machines to keep them at the highest point of efficiency; the purchase of patents and the cost of administration. President Winslow of the United Shoe Machinery Company has repeatedly said: "IT ASSUMES ITEMS OF EXPENSE AND RISK WHICH, UNDER ANY OTHER SYSTEM YET SUGGESTED, THE SHOE MANUFACTURER WOULD BE COMPELLED TO ASSUME HIMSELF, THUS SUBJECTING HIS BUSINESS TO A GREATER MACHINERY COST PER PAIR THAN THE AVERAGE ROYALTY HE NOW PAYS."

Is it any wonder that shoes are so cheap?

KEEPING SHOE MACHINERY UP TO DATE.

Nearly all the modern machines to be found in the bottoming department of a shoe factory were either invented or perfected by the United Shoe Machinery Company. Some of them were invented by outside inventors who were not connected with the United Shoe Machinery Company, but who sold their patents to the United Shoe Machinery Company at a fair price. But most of them were *deliberately created* by a highly paid staff, to meet the needs of shoe manufacturing. No really good mechanical idea is lost or abandoned for lack of mental or financial support. FROM $500,000 TO $900,000 A YEAR ARE SPENT IN IMPROVING OLD MACHINES OR DEVISING NEW MACHINES.

If the inventors of the United Shoe Machinery Company are once convinced that some step in the making of a shoe can be accomplished in a simpler, cheaper, and speedier way, all the resources of the company are placed at their disposal.

It used to be the practice, for example, to fit the parts of a shoe upper to the wooden last by hand. This operation was expensive. It required so much skill and patience that few thought it possible to carry it out by machine. Finally the lasting machine was invented which cared for a part of this operation. It was still necessary, however, by means of pincers to pull the leather over the nicer curves of the last before tacking it in place, and the inventors of the United Shoe Machinery Company were confronted with the problem of contriving a "pulling over" machine. This problem was solved by them at a tremendous cost. They worked for years and they spent over one million dollars. When they had at last finished their task the famous "Rex pulling over" machine was produced. *Despite all the time, all the money, that was expended on this machine, the shoe manufacturer pays a royalty of only three eighths of a cent for each pair of shoes made by its means,* and this small royalty also covers the use of several other machines used in the pulling over process.

IT IS THIS POLICY OF CONSTANTLY IMPROVING MACHINERY THAT HAS KEPT THE PRICE OF SHOES DOWN.

SCRAPPING MACHINES.

Many manufacturers in other industries CANNOT AFFORD TO DISCARD OBSOLETE MACHINES. They have invested too much money in them. Their manufacturing costs are often high because their equipment is out of date.

Every new invention produced by the United Shoe Machinery Company means the "scrapping" of hundreds of machines at the United Shoe Machinery Company's expense. In a single year no less than four thousand machines have been withdrawn to make room for machines embodying the latest improvements. It does not matter if the shoe factory is large or small. All factories receive the latest improved machines. United shoe service is rendered to all on equal terms.

The "Rex" pulling-over machine, which was developed at a cost of over $1,000,000, and which fits the parts of the shoe upper correctly to the last.

THAT IS STILL ANOTHER REASON WHY THERE IS NO SHOE TRUST.

THAT IS WHY EVERY SHOE FACTORY IN THE UNITED STATES, LARGE OR SMALL, ALWAYS HAS AN EQUIPMENT ABSOLUTELY MODERN—THE LAST WORD IN MECHANICAL INGENUITY.

THAT IS WHY THE PUBLIC IS ABLE TO BUY SHOES WHICH ARE CONCEDED TO BE THE BEST IN THE WORLD, AT A PRICE TO MEET EVERY PURSE.

THE REPAIR SERVICE.

Whenever a shoe machine is disabled, the telephone or the telegraph will bring the nearest United Shoe Machinery expert to the shoe factory. Machines are thus maintained in perfect condition without charge.

Over five hundred repair experts are kept constantly on duty at the beck and call of shoe manufacturers. This expert service means that 100,000 catalogued machine parts must always be kept in stock in the Beverly plant of the United Shoe Machinery Company. Over twenty-one million parts of machines are sent out from the stock room annually to various branches of the United Shoe Machinery Company.

AS A RESULT OF THIS REPAIR SERVICE, EVERY SHOE MANUFACTURER CAN COUNT ON HIS MACHINERY, AND HENCE ON HIS PRODUCTION. His profits are assured.

THERE IS NO MONOPOLY.

THE UNITED SHOE MACHINERY COMPANY DOES NOT MANUFACTURE OR CONTROL *ALL* THE MACHINERY USED IN SHOE MAKING. Its service is confined largely to supplying the machines for lasting and bottoming shoes. In most factories machines for stitching, treeing or finishing shoes, and for working sole leather can be found, which were supplied by other companies, and which are installed side by side with United shoe machinery.

No shoe manufacturer need deal with the United Shoe Machinery Company if he does not choose to do so. He can equip his entire factory with machines which are not made by the United Shoe Machinery Company. If, therefore, the United shoe equipment is to be found in nearly all the 1,200 shoe factories in this country, it must be because it is so highly efficient, and because the manufacturer obtains not merely machines, but SERVICE—a service that enables him to fulfill his contracts to the day and TO SELL SHOES TO THE PUBLIC AT A LOW PRICE AND A SMALL MARGIN OF PROFIT.

The only monopoly which the United Shoe Machinery Company enjoys is the legal monopoly granted by the patent laws of this country to every inventor. Any one who takes out a patent enjoys exactly the same kind of a monopoly. After the expiration of seventeen years—the term for which patents are granted in this country—any one is free to make, use, and sell the invention disclosed in the patent.

The patents on many United shoe machines have expired. Others are free to appropriate the ideas disclosed in them, and others have done so.

The existence and success of the United Shoe Machinery Company depend not only on effective service, but also on the invention of new shoe machines, which will improve factory methods and which will improve the quality of shoes and keep the price down.

HOW THE SHOE INDUSTRY HAS PROSPERED.

The liberal business policy of the United Shoe Machinery Company has made shoe manufacturing one of the leading industries in this country.

Before 1899, when the United Shoe Machinery Company was formed, the products of American shoe factories were worth $258,000,000. Ten years later they were worth $442,600,000—*an increase of seventy per cent.*

THE WAGES of those employed in American shoe factories INCREASED FIFTY-SIX PER CENT between 1900 and 1909, or from $59,176,000 to $92,359,000.

Our shoe exports were very small in 1899. They amounted to only $1,816,538. In 1912 the value of imported shoes was $17,380,634, *an increase of more than 850 per cent.*

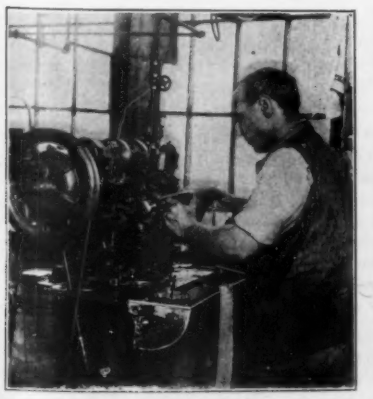
This wonderful growth is due chiefly to the liberal business methods and the factory service policy of the United Shoe Machinery Company. The wealth of this country has been increased by millions because the United Shoe Machinery Company has systematically invented new machinery to lessen the cost of shoe manufacture and to improve the quality of shoes. AS A RESULT, THE SHOE INDUSTRY OF THE UNITED STATES LEADS THE WORLD.

SHOES ARE NO LONGER LUXURIES.

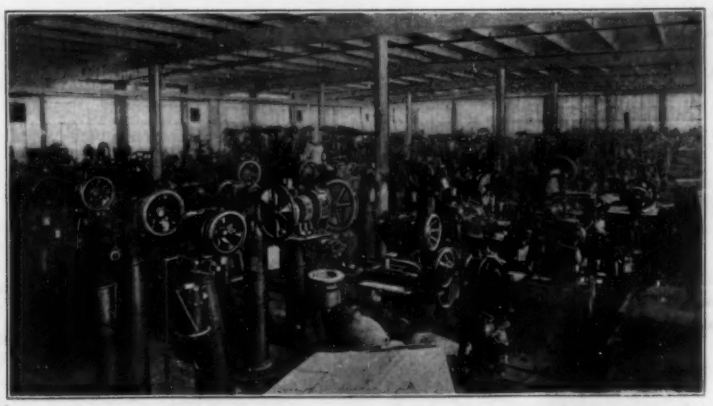
Nowadays everybody wears shoes. Yet there was a time within memory when shoes were luxuries. A pair of handsewed welt shoes once cost from $10.00 to $16.00. Only the rich wore them every day. Yet now you pay from $3.50 to $5.00 for a pair of Goodyear welt shoes, much more comfortable and much better in quality than the $10.00 handsewed shoe your father or your grandfather wore. What is more, *you, as an average American, buy three pairs of shoes a year.* Shoes are no longer a luxury.

JUDGE FOR YOURSELF HOW MUCH OF ALL THIS IS DUE TO THE POLICY OF THE UNITED SHOE MACHINERY COMPANY.

Advertisement.



Outsole rapid lockstitch machine of the latest type, used to fasten the outsole with a lockstitch to the welt in making a Goodyear welt shoe.



Part of a museum in which two thousand types of shoe machines are preserved, which were once in use, but which have been superseded by better types. Four thousand machines have been "scrapped" in a year by the United Shoe Machinery Company to make room for more efficient types.

A loose nailing machine. This apparatus is used in fastening the "heel seat" of the shoe preparatory to attaching the heel.

It Heals Tire Cuts

You want to cut out tire repair waste—then you need this self-vulcanizing tire repairer—it does, itself, the extra work you've had to do yourself with the ordinary tire repair mastic. All you have to do is to apply it—it does the rest. Fills the cuts and holes, solidifies quickly and *becomes like a part of the tire.* No car owner can afford to be without it. Reduce tire expense 30 per cent—use

NARCO TIRE CUT FILLER

Requires No Kneading

a non-shrinking, rubber compound, heavy in rubber; a combination cement, cut filler and mastic. Refills and unites the torn place in the tire with a permanent plug of rubber more resilient than the tire itself. Welds the loosened tread to the canvas body. Supplied only in patent, collapsible tubes, with tapering spout.

Easy to Use

All you have to do is to clean the cut thoroughly with gasoline—remove all oil, sand and other foreign matter; insert the tapering spout into the cut and compress the tube, smooth off the cut filler and the repair is completed. Allow it to heal over night; in the morning it will have become **like a part of the tire.** Rivets itself to the walls of the cut, forming a union so perfect no road abuse can remove it.

This is the logical manner of tire repair. Every automobile owner in America should make Tire Cut Filler a part of his repair outfit and begin saving in tire cost **now.**

Very Large Tube, $1.00. $1.50 in Canada. Money refunded if not satisfied.

On Sale at All Dealers.

If yours can't supply you, we will. Send dealer's name and $1 00; in Canada, $1 50.

TIRENEW TRADE MARK

waterproofs the outer rubber casing of the tires and penetrates down into the inner fabric, protecting it from oil, air and moisture. Preserves the tires and prevents decay. Spread it over the surface of your tires after mending with Tire Cut Filler. **Makes tires look like new.**

There are imitations which paint but don't protect—insist on Tirenew.

NATIONAL RUBBER COMPANY
4405 PAPIN STREET, ST. LOUIS, MO.

Notes for Inventors

Film for Moving-picture Machine.—George W. Bingham of Brooklyn, N. Y., assignor to Bingham-Cameron Company of New York, has patented, No. 1,045,502, a film for moving-picture machines which comprises a disk of celluloid or like transparent material provided with a series of pictures arranged progressively on the disk, the disk having an opening located in advance of the series of pictures and of sufficient size to permit free passage of the beam of light emanating from the projection apparatus of the machine.

The Patents of the Bath Trust.—The patents owned by the Bath Trust, recently dissolved by order of the Supreme Court of the United States, cover principally enameling processes. The major patent of the trust was that granted September 26th, 1899, to James Arrott, Jr. Prior to his invention, the enameling powder was applied by a sieve, attached to a long handle, which was held by the workman with one hand and the sieve made to vibrate by the workman striking the handle with the other hand, thereby sifting the powder over the surface of the iron ware. The instrument was an imperfect one, not easily handled, and by its use the workmen were subjected to intense heat and physical strain. Besides, the flow of the powder was not continuous; it was cast upon the metal in intermittent puffs, causing in many instances an unequal distribution of the powder and producing defective articles, which either had to be thrown away or sold as "seconds." With Arrott's invention these evil results are lessened or disappear. The sieve is mechanically vibrated very rapidly, causing, instead of an intermittent flow of the powder as in the hand process, a practically continuous flow. Both hands of the workman may be used to guide and direct the sieve. The advantages of the instrument over the hand process are decided. It is more efficient and more economical. It makes a better article and in less time. There is no waste in "seconds." The workman is relieved to some extent from the fierce heat. Other patents owned by the Bath Trust are those granted to E. Dithridge for a pneumatic sieve, and a patent to William Lindsay for an enameling powder distributor. These are improvements on the Arrott invention.

Protecting Moving Picture Films.—In a patent, No. 1,042,801, Isidor Kitsee, the Philadelphia inventor, suggests that he has found that if a nitrated material is embedded in a carbonate compound, the gases given off by said material are neutralized, the temperature remains stationary and no deterioration is ascertainable. When two films, each inclosed in a receptacle, are subjected to a higher temperature, one film embedded in a carbonate, the other film minus the carbonate, then the film without the carbonate will inflame at a far lower temperature than the film embedded in the carbonate, for the reason that the gaseous products of the film embedded in the carbonate are neutralized as soon as they are given off, whereas the gaseous products of the other film tend to raise the temperature and explode. To protect, therefore, a film used for kinematographic exhibition, he embeds the same in a carbonate of ammonium compound, such for instance as a bi-carbonate of ammonium, sodium, etc., and the container for the storage of films has a lining impregnated with a neutralizing agent for the gases given off by the film.

A Running Support for Flying Machines.—Michael A. Parisano of New York city, in a patent, No. 1,049,521, shows a flying machine with trucks pivotally mounted on opposite sides of the main frame so they can swing transversely and having wheels at their opposite ends and springs connected with the trucks on opposite sides of their pivotal points.

A Convertible Tank Vessel.—A novel construction of convertible freighter and tank vessel is shown in the patent, No. 1,049,490, to Charles P. M. Jack of New York city, and includes a ship's hull and a number of removable cylindrical tanks which are placed vertically in the hold so they can be raised from and inserted therein and adjustable means are provided for connecting the tanks together and to the sides of the hold.

Resignations from the Patent Office Examining Corps.—Notwithstanding the increase in salary accorded the assistant examiners of the U. S. Patent Office, resignations still continue frequent and during the past year the examining corps has suffered by twenty-four resignations. One of these was a principal examiner. During the same period several members of the corps have died, including one principal examiner.

Preventing Thumb Sucking.—Jessie May Mitchell of Clayton, Miss., has procured a patent, No. 1,048,569, for a thumb and finger-sucking preventer in which there is a stall fitted on the thumb or finger and a round disk, too large to be inserted in the mouth, is held by the stall on the end of the thumb or finger so the latter cannot be put in the mouth.

Vermin Trap.—A patent, No. 1,048,479, the invention of Joseph Andel of Chicago, Ill., has issued for a vermin trap in which a hollow body has perforated walls and a honeycombed structure within the body for the reception of vermin, and the perforated end walls are controlled by slides which have openings registrable with the openings and movable so the slides can be adjusted to close the wall openings.

A Trap Set by Foot.—Maurice F. Richardson of Southington, Conn., has secured a patent, No. 1,048,586, for a spring trap which has a pan and a latch to hold the jaws open and is provided with lateral foot engaging extensions at the opposite sides of the jaws so that the trap can be set by the feet pressing upon the extensions.

An Improved Beehive.—Francis Danzenbaker of Norfolk, Va., a well-known inventor of beehive improvements, as assignor to Robert Johnson, has secured patent No. 1,048,950, for a beehive, the body of which has a ledge for supporting frames or holders and a filling rail for the spaces above the ledge and provides a strip of treated material between the filling rail and the adjacent hive members.

An Electric Rat Trap.—Michal Morawiecki of Pittsburgh, Pa., has secured a patent, No. 1,048,995, for an electric rat trap which has a tilting platform and a pair of electrodes below the normal plane of the platform with the free opposing ends of the electrodes spaced apart and forming a mouth and operating to control and cooperate with the tilting platform.

A Novel Form of Brake Head.—Frederick R. Cornwall of St. Louis, assignor to Chicago Railway Equipment Company, has secured a patent, No. 1,045,261, for a brake head which has an opening of such size as to permit the introduction of the brake beam with overlying means for securing the brake beam in order to hold the head on the beam in suitable adjustment.

A Gas-chain Fixture.—Frederick DeWitt Pitcher of Rochester, N. Y., assignor to Welsbach Light Company, in patent No. 1,046,489 shows a gas-chain fixture in which the gas-supply pipe extends adjacent to the links with its ends extending into socket members provided on the end links of the chain and connected thereto so that suitable connections may be made with said socket members to communicate with the gas-supply pipe carried by the chain.

Heating Hosiery Electrically. — The General Electric Company as assignor of Frederick M. Vogel of Pittsfield, Mass., has secured patent No. 1,046,514 for a device for drying hosiery in which there is an electrically heated metallic form corresponding generally to the shape of a stocking and having interchangeable toe portions with a resistance conductor extending into the form and the toe portions so that the form may be heated throughout.

Horseshoes by Centrifugal Casting.—Reasoning from the dental practice of taking impressions of cavities and then casting by the aid of centrifugal action fillings to fit the cavity, the writer heard it suggested recently that some one might invent a means of producing well fitting and suitable horseshoes by taking impressions of the prepared hoof and then casting in a centrifugally operating apparatus a shoe to fit the hoof.

Trade-mark Notes

"Ritesize" Held Registrable Trade-mark for Knit Goods.—Mr. Commissioner Moore in *ex parte* Ritesize Underwear Company has held the word "ritesize" as applied to underwear is not descriptive of such goods and is registrable as a trade-mark therefor. In the decision the Commissioner says "in the case of underwear, however, there can be no particular size which could be described as 'ritesize,' whether this expression is considered to refer to absolute size or to the proportion of one part to another, since there is no given size or proportion in underwear which could be considered a right size any more than any other."

"Brilliant" Not Registrable for Flour.—In the case of Sauers Milling Company v. Kehloe Flour Mills Company, the Court of Appeals of the District of Columbia in holding that the word "Brilliant" as applied to flour is descriptive and not registrable as a trade-mark for flour, said: "The testimony shows that it indicates bright flour that shows up well and is of a superior quality as distinguished from the darker brands, and that the bright flour is considered of greater value, and more sought after by purchasers than the darker brands."

Chamber of Commerce in its Relation to Patents, Trade-marks and Copyrights.—The Chamber of Commerce of the United States of America, with general offices in the Riggs Building at Washington, D. C., has appointed its committee on patents, trade-marks and copyrights in several groups located at Rochester, N. Y., Detroit, Mich., and Washington, D. C. The groups have individual chairmen and are composed of follows:

Rochester, N. Y.

James G. Cutler, Rochester, N. Y., chairman (President Alliance Bank; President Cutler Mail Chute Company and Realty Company.)
George Eastman (President of the Eastman Kodak Company.)
Henry W. Morgan (University Avenue, Rochester, N. Y., Vice-president and General Manager Morgan Machine Company, box making machinery and nailing machines.)
George W. Todd (G. W. Todd & Co., manufacturers of protectographs, Rochester, N. Y.)
Edward G. Minor (President and General Manager the Pfaudler Company, Rochester, N. Y.)

Detroit, Mich.

James Whittemore, Detroit, Mich., chairman. (Patent Attorney, Whittemore, Hulbert & Whittemore, Wayne County Savings Bank Building, Detroit.)
John Trix, Detroit, Mich. (President American Injector Company.)
Henry M. Leland, Detroit, Mich. (President Cadillac Motor Car Company.)
Howard E. Coffin, Detroit, Mich. (Vice-president Hudson Motor Car Company.)
C. A. Strelinger, Detroit, Mich. (Dealer in machinery supplies, the Charles A. Strelinger Company.)

Washington, D. C.

Gen. Ellis Spear, 9th and Grant Place, chairman. (Former Commissioner of Patents and well known patent attorney.)
W. W. Kincaid, Meadville, Pa. (President the Spirella Company.)
Perry B. Turpin, (625 F Street, Washington, D. C. Represents SCIENTIFIC AMERICAN also Munn & Co.)
Joseph R. Edson. (Washington Loan and Trust Building, Washington, D. C., patent attorney.)
William G. Henderson. (501 F Street, Washington, D. C., patent attorney.)

It is not the purpose of the Chamber of Commerce to have one general committee, but rather to have each group consider the subjects and reach its conclusion and possibly correspond with the other groups with a view to securing reports from the several groups which instead of being sectional will be in a way national and at the same time give recognition to the different viewpoints of the various sections of the country in which the groups are located.

A Trade-mark Decision.—In deciding the case of *ex parte* Callahan & Sons, First Assistant Commissioner of Patents Billings, in holding that a combination of non-registrable words is not registrable, quotes the answer of the Examiner of Trade-marks, stating that he has correctly stated the law relating to this type of marks. In his statement the Examiner of Trade-marks says: "It is true that a surname if distinctively displayed is registrable; . . . a geographical term and descriptive words, even if distinctively displayed, are not registrable;" and refers to the decision of the Court of Appeals of the District of Columbia *in re* Meyer Brothers Coffee and Spice Company as directly ruling that the combination of non-registrable words does not produce a registrable mark.

Legal Notes

High-tension Insulator Case.—In the interference case of Hewlett v. Steinberger, involving an important feature of high-tension insulators, and referred to in the SCIENTIFIC AMERICAN of April 19th, the Court of Appeals of the District of Columbia has rendered a decision affirming the award of priority to Steinberger.

Designs Must Involve Invention.—Mr. Commissioner Moore in the case of *ex parte* Mygatt has held that in order that a design be patentable it must not only be new and ornamental, but there must have been an exercise of the inventive faculty in its production, citing the Court of Appeals case of *in re* Schraubstadter, 26 App. D. C., 331.

Adjudication of Cracker Package Patent.—In Peters v. Chicago Biscuit Company *et al.* in 200 Fed. Rep., 774, the District Court, N. D., Illinois, E. D., speaking by Justice Kohlsaat, Circuit Judge, has held that the Peters patent, No. 621,974, for a method of and means for packing biscuits, crackers and the like, the package consisting of a carton having an interfold lining of wax or paraffin paper to exclude the dust and moisture, is void for lack of patentable novelty in view of the prior art. The court refers to the object sought being the approximate exclusion of air, moisture, dirt and insects, and to this end being in practice further accomplished by complainant's exclusive licensee, the National Biscuit Company, by the use of an outer sealed wrapper or envelop entirely inclosing the package and contents, which wrapper the patentee asserts is mainly for advertising purposes by the licensee.

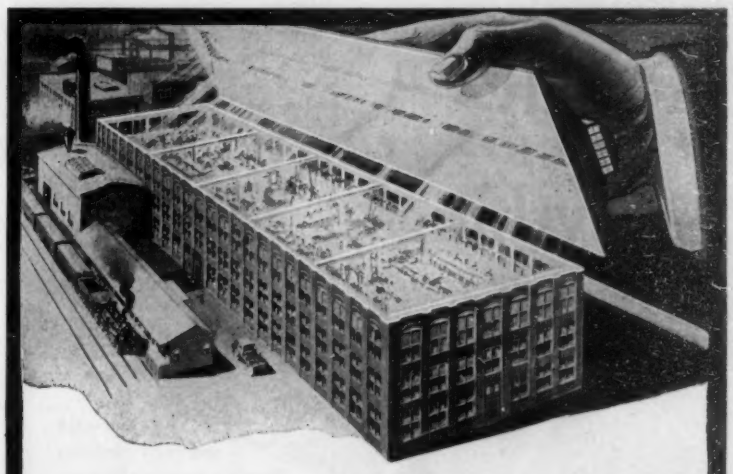
Outstanding Licenses Disregarded in Issuing Patents.—In *ex parte* Dudley, the Commissioner of Patents has decided that

"Hereafter, therefore, in issuing either original or reissue patents, grantees of interests therein shall not be considered to be other than assignees because of any outstanding license or licenses, whether exclusive or not, and the patents shall issue to the same parties as they would if such licenses did not exist."

The question arose in connection with the issue of a reissue patent, the Revised Statutes specifically pointing out to whom reissue patents shall be granted, whereas original patents are issued under the general provisions of the statute which leaves it discretionary with the Commissioner whether the patent shall issue to the inventor or the assignee.

Decision in Interference Case.—Assistant Commissioner Tennant in Bump v. Reasoner has decided that where, in an interference involving an application and a patent, the applicant filed a concession of priority to the patentee, judgment rendered upon this concession will not be set aside upon an allegation that the applicant was deceived as to duration of a license granted by a patentee. It appears from the statement of the case that a party acting on behalf of Bump obtained from Reasoner an assignment of his right, title and interest in the patent involved and that Bump was informed that a license had been granted, but understood that the license was for but a year and had expired, whereas it seems the license has not expired.

Intervening Rights in Reissue Applications.—Assistant Commissioner Tennant in the case of Perkins & Requa v. Weeks holds that where in an interference involving an application for a reissue of a patent, a motion is brought to dissolve upon the ground that intervening rights accrued in favor of the opposing party by the issuance of a patent between the date of the original patent and the date of filing the application for reissue, such motion was properly refused transmission, since the mere grant of a patent between the issuance of an original patent and the filing of application for reissue thereof does not constitute an intervening right.



You can increase your factory light

19 to 36 per cent. by not wasting the light you already have

If your ceilings and walls absorb instead of reflect light, you are wasting light—the artificial light for which you pay good money as well as the daylight which comes in through your windows. Paint your ceilings and walls with

RICE'S MILL WHITE

It will reflect *every ray of natural or artificial light* down on to your machinery and into the dark corners of your plant. It will enable you to utilize floor space now useless for fine work. It will lengthen your daylight day at both ends.

RICE'S Mill White will not crack or craze under the jar of machinery. It will not scale or flake like a cold water paint. Its firm, tile-like surface affords no lodgment for germs and odors.

RICE'S Mill White is economical to apply. It flows evenly with no brush marks under a 4-inch brush. Its great covering power and intense body make *two coats equal to three of lead and oil. It remains white longer than any other gloss paint.*

Suited to Any Surface

RICE'S Mill White can be applied to wood, concrete, brick—practically any surface over Rice's undercoats. It was the pioneer "Mill White" Paint. It made the reputation of the name "Mill White." The *special process* by which Rice's Mill White Paint is made *cannot be used by any other paint manufacturer.*

RICE'S Mill White is sold direct from our factory in barrels containing sufficient paint to cover 20,000 square feet, one coat. If you have that area or more of ceiling and wall space to cover,

Write for Booklet and Sample Board

RICE'S GRANOLITH
A tough, elastic permanent finish for concrete walls. Becomes a part of the cement to which it is applied. One coat sufficient, unless a gloss is desired. Makes the best possible primer on inside concrete and brick for a second coat of RICE'S Mill White Paint, giving a tile-like, enamel finish at no more expense than lead and oil paint.
For Concrete Surfaces

Ask for a copy of our booklet, "More Light." It will give you a lot of information about interior factory paints and the names of many prominent users of RICE'S Mill White. *Write today.*

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Ready
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Anything
—at any time.
Slippery pavements
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For each and every condition there's a particular feature of safety and service in
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Oilproof
VACUUM CUP TIRES
The suction hold of the vacuum cups, guaranteed to prevent skidding on wet or greasy pavements—
The absolutely oilproof quality, immune against deterioration from oily roads and garage floors—
The thick walled cups that drive deep and give unequaled traction in mud or sand—and thrust aside sharp stones and puncturing objects—
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And finally the definite printed guarantee of 4,000 miles attached to each casing—a distance far exceeded by the actual average service mileage.
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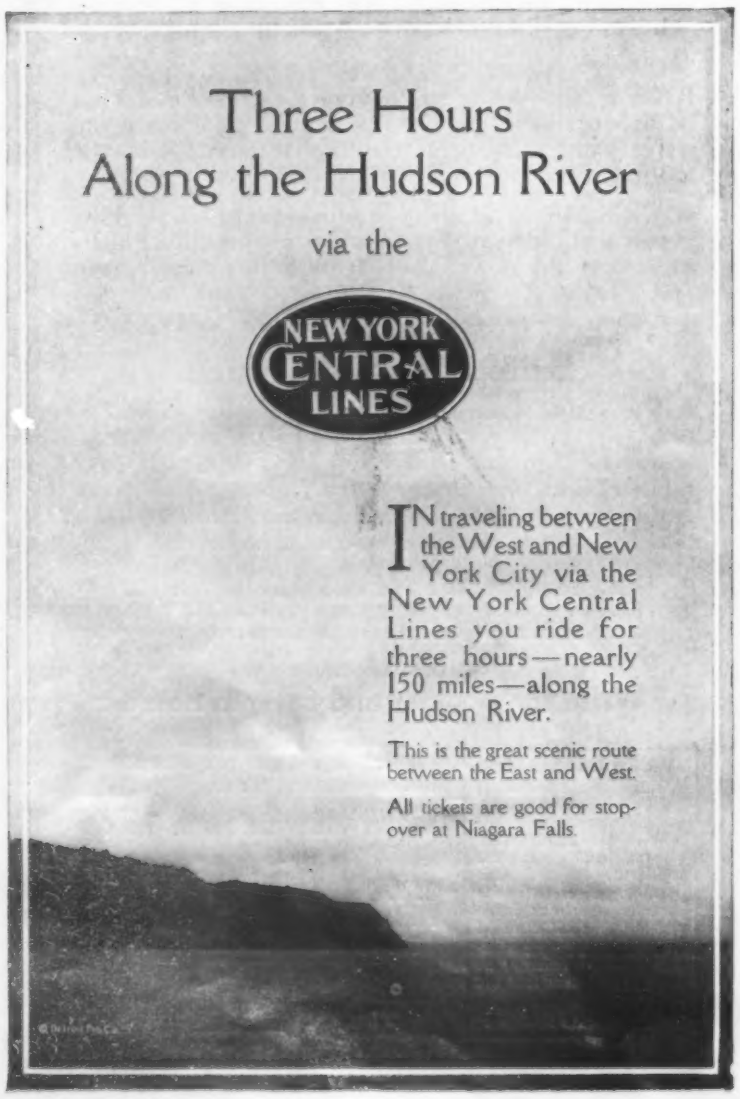
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How Patented Inventions Have Increased the National Wealth

IN these days when great industrial dragons of capital guard every door of business opportunity, it is grateful to know that there is one open sesame left.

During the past spring, after a bill was introduced to restrict the rights of inventors in their inventions, Congress had the opportunity of hearing from the largest corset manufacturer in the United States, the biggest manufacturer of carpet sweepers, the best-known manufacturer of inexpensive watches, the manufacturer of the most advertised alarm clock in America, the two best-known safety razor manufacturers in the country, the largest manufacturer of cameras and photographic supplies in the world, all the phonograph and talking machine manufacturers in the United States, and most of the manufacturers of the specialties that newspaper and magazine advertising have made household words. Besides these, Congress also heard from the leading inventors of the country, the members of the Inventors' Guild, most of the engineering and electrical and commercial associations, and, finally, from Mr. Thomas A. Edison himself.

What these men had to say about the calamities which would follow if the rights of inventors were restricted so astonished the Committee on Patents, that the Committee decided not to press this Bill for the present. For all that, it will probably be presented at the coming session, for which reason its objectionable provisions should not be lost to view.

These manufacturers and inventors all told one story: to-day invention, protected by patent, is in all commercial activities the chief, and often the only way by which business independence may be attained.

All this explains why Americans lead the world in invention; why the patents taken out in the United States average nearly 40,000 a year and now aggregate nearly 1,100,000; and why the patents issued by the United States are nearly equal, in annual output and in aggregate amount, to all the patents issued by Great Britain, Germany and France combined. Laid end to end, the patents which have been issued by the United States Patent Office would reach three times around the world. Placed in a pile 10 feet square they would form a mass twice as high as the Washington Monument.

How tremendously patented inventions have contributed to the prosperity of the United States appears from the growth of industries depending entirely on inventions.

In the generation between 1880 and 1910, the value of our iron and steel manufactures leaped from $207,000,000 to $1,377,000,000, an increase of 566 per cent. Between 1860 and 1910 the output of sewing machines grew from less than $4,500,000 to over $28,000,000, an increase of 522 per cent. Between 1850 and 1910 the production of agricultural implements increased from less than $21,000,000 to over $146,000,000, an increase of 595 per cent. In the generation from 1880 to 1910 the output of photographic apparatus increased from $142,000 to nearly $16,000,000, an increase of 1,117 per cent.

Coming down to more recent examples of manufactures covered by patents:

In the decade between 1899 and 1909 the output of automobiles leaped from less than $5,000,000 to over $249,000,000, an increase of 4,880 per cent; the production of wire increased from less than $9,500,000 to nearly $90,000,000, an advance of 847 per cent; the output of phonographs from about $2,000,000 to nearly $12,000,000, a growth of 500 per cent; the production of cash registers and calculating machines from about $5,500,000 to nearly $24,000,000, an increase of 336 per cent; the output of patented food preparations from $39,000,000 to $125,000,000, a growth of 220 per cent; the production of fountain pens from a little over $1,500,000 to over $4,500,000, an increase of 200 per cent; the output of photo-engraving from $4,000,000 to over $11,500,000, an increase of 188 per cent; the output of photographic products from less than $8,000,000 to over $22,500,000, an increase of 181 per cent; the pro-

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MISCELLANEOUS

SEALED PROPOSALS, endorsed "Proposals for Two 300 ft. Steel Towers," will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 o'clock a. m., June 14, 1913, and then and there publicly opened, for the construction of two steel towers at the Naval Radio Station, San Juan, Porto Rico. Estimated weight of structural steel work, 100 tons. Plans and specifications can be obtained on application to the Bureau. Wm. M. Smith, Acting Chief of Bureau. April 19, 1913.

INQUIRIES

Inquiry No. 9307. Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

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The greatest care in every detail makes the APLCO "the starter that never stops starting"

A corner
of our testing rooms

Every Aplco Electric Starter

that is finished in the Apple Electric Co.'s plant is submitted to a rigid final inspection by a corps of engineers under the direction of Mr. Vincent G. Apple himself. He is unwilling to risk the slightest possibility of any imperfection; the Aplco electric starter is his greatest achievement and he is determined that anyone who is fortunate enough to buy a car equipped with the Aplco system shall have no reason to regret his choice.

Electric starters are new to most of you buyers of cars; in fact they are a little new to the car manufacturers themselves. But they are not new to Mr. Apple. He had his first electric starter out on road tests several years ago; since then his best efforts and those of his engineers have been directed towards correcting any shortcomings developed by long continued service. Any good plant can make a starter that begins well and gives results for a few thousand miles. Mr. Apple has been working on the other kind.

The Aplco electric starter, as it is found this season in 1913 cars, is the best, the most efficient and the most reliable and the lightest electric starter that can be put into an automobile.

This is the kind of starter you've been needing; it's the kind you want on any car you buy this year or next.

Superior Points of the Aplco System

The whole Apple system is built in one plant, under the final supervision of one man. Everything—dynamo, motor, batteries, controllers, are built to work with each other with mechanical precision; they must test out together. Vincent G. Apple stands back of the entire system, not a part of it. All this is very different from some of the most widely advertised starters which are composed of units of which only part are made by the firm which offers you the starter. Some make the dynamos and buy the batteries and motors elsewhere, assembling the units, and so on. The result? The generator designed by one man does not properly feed the battery made in the other man's factory, for instance—the user complains to the car builder, who refers him to the starter maker, who blames the battery manufacturer. Between them all, you—the owner of the car—get no satisfaction.

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There are no sliding or exposed gears, no pedals to push, no meters to watch. The glow of a small lamp shows whether the system is working properly. One lever on the controller is all you have to deal with.

The Aplco regulator forces the dynamo to supply an absolutely uniform voltage at all speeds above that equalling ten miles per hour of the car.

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duction of rubber goods from $52,500,000 to $128,500,000, an increase of 145 per cent; the production of typewriters from less than $7,000,000 to nearly $20,000,000, an increase of 185 per cent; the production of electrical machinery from $92,000,000 to $221,000,000, an increase of 140 per cent.

The increase in our national wealth produced by commercial inventions is recorded in staggering figures:

In 1905 our manufactures of iron and steel products aggregated $2,177,000,000; our manufactures of textiles amounted to $1,387,000,000; our production in the printing and publishing trades was $597,000,000, and our manufactures of petroleum products totaled over $175,000,000. During the five years between 1905 and 1910 these manufactures increased, on an average, nearly 30 per cent.

During the two generations from 1850 to 1910 the production of cotton manufactures jumped from less than $62,000,000 to over $628,000,000, an increase of 913 per cent. In the same period the production of woolen manufactures leaped from about $48,500,000 to over $507,000,000, an increase of 946 per cent. Over the same years the production of silk manufactures increased from less than $2,000,000 to nearly $197,000,000, an increase of 9,750 per cent. In these three industries alone, each of which owes its very existence to machinery made possible by patented inventions, the amount of wealth produced in 1910 aggregated the enormous sum of nearly $1,333,000,000.

How widely this enormous wealth is diffused among independent manufacturers and their employees appears from the figures of several representative industries:

Between 1850 and 1910 the capital engaged in the manufacture of agricultural implements grew from $3,500,000 to $256,000,000, affording occupation in 640 individual establishments to nearly 60,000 employees, who received in the aggregate nearly $40,000,000 annually in wages. During the same period the capital engaged in making sewing machines grew from $1,500,000 to $33,000,000, affording occupation to 21,000 employees, who received annually $12,500,000 in wages. In the generation between 1880 and 1910 the manufacturers engaged in the making of electrical machinery grew from 76 concerns with $1,500,000 capital to 1,009 concerns with $268,000,000 capital, affording occupation to nearly 106,000 employees, who received in the aggregate about $70,000,000 in wages.

Coming down to more recent examples: What can be more impressive than the growth of the automobile industry? During the decade from 1899 to 1909 the automobile manufactures grew from 57 establishments with $5,500,000 capital to 743 establishments with nearly $174,000,000 capital. The number of employees, meanwhile, increased from 2,509 to 85,359. The wages paid to these employees increased during this period from $1,500,000 to $58,000,000.

Between 1899 and 1909 the establishments engaged in wire manufactures increased from 29 to 56; their capital grew from $4,000,000 to over $60,000,000; the number of their employees increased from 1,700 to 20,000; their aggregate wages rose from less than $1,000,000 to $12,500,000.

During the same period the establishments engaged in the manufacture of typewriters increased from 47 to 89; their capital grew from less than $8,500,000 to over $26,000,000; the number of their employees increased from 4,800 to over 12,000; their aggregate wages rose from $2,750,000 to nearly $9,000,000.

Over the same period the establishments engaged in the manufacture of patented food products increased from 645 to 1,213; their capital grew from $21,500,000 to $64,500,000; the number of their employees increased from 9,700 to 21,000; their aggregate wages rose from $4,500,000 to nearly $13,000,000.

In the same decade the establishments engaged in the manufacture of optical goods increased from 91 to 217; their capital grew from $60,000,000 to $104,000,000; the number of their employees increased from 12,300 to 22,000; their aggregate

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It's the *rim* as much as the *road* that wears out your tires.

So we said to our Engineers:

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They did—and they also added the No-Pinch Safety Flap for inner tube protection in

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Each point of rim contact in a tire is a point of support. Where the points of rim contact are not perfect, undue pressure is brought to bear at an unsupported point of the tire.

Then what happens? The result is a terrific strain on the tire that results in rim troubles, breaking above the bead and separation of the tread from the carcass.

All this is overcome in the Diamond No-Clinch because the three-points of rim contact are absolutely *mechanically perfect*—the annealed steel cable wire bead holds with a vise-like, rim-grip.

Add to this the No-Pinch Safety Flap for inner tube protection, the Vitalized Rubber advantage, the famous Diamond Safety (Squeegee Tread) and you have bought rubber shod mileage that has no equal at any price.

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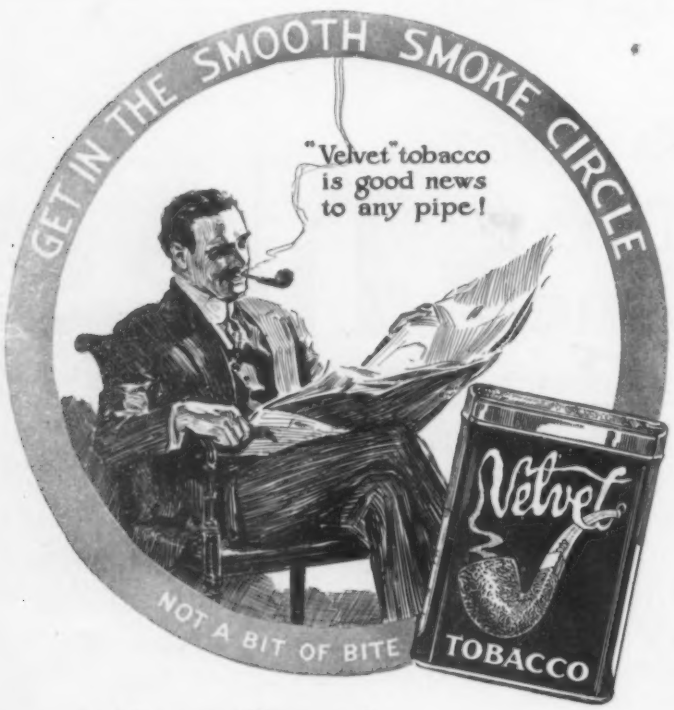

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wages rose from $10,000,000 to $18,500,000.

Throughout the same period the establishments engaged in the manufacture of phonographs increased from 11 to 18; their capital grew from $3,000,000 to $14,000,000; the number of their employees increased from 1,400 to 6,000; their aggregate wages rose from $1,750,000 to $8,000,000.

Over the same years the establishments engaged in the manufacture of fountain pens increased from 43 to 65; their capital grew from $1,000,000 to over $3,000,000; the number of their employees increased from 742 to 1,820; their aggregate wages rose from $500,000 to $1,125,000.

During the same decades the establishments engaged in the printing and publishing business increased from less than 24,000 to nearly 32,000; their capital grew from $333,000,000 to over $588,000,000; the number of their employees increased from 136,000 to 389,000; their aggregate wages rose from $139,000,000 to $268,000,000.

* * *

The value of American manufactures attributable directly or indirectly to patented inventions is stupendous. In 1909 it amounted to nearly $21,000,000,000—one fifth of all the wealth of the United States; six times the total money in circulation; twenty times as much as would be required to pay the national debt; and two hundred and sixteen times the value of all the gold produced in the United States. The amount of wages which these industries paid out in 1910 amounted to nearly $5,000,000,000—more than half as much as the total wealth of the United States in 1850; about two thirds as much as the total money in circulation in 1910; seventeen times the total wages paid in the United States in 1850; and seventy-one times the total amount of money coined in 1910. To invention, more than to any other cause, is due the fifteen-fold increase of wealth in the United States from $7,135,000,000 in 1850 to $107,104,000,000 in 1909. Human comprehension is inadequate to grasp such figures.

That wealth produced by patented inventions is more widely distributed among employees and independent manufacturers than wealth produced in any other fashion is strikingly shown in the boot and shoe industry. Between 1900 and 1905 the capital invested in the industry increased from about $99,000,000 to $122,500,000, an increase of over 23 per cent; and during the five years from 1905 to 1910 the capital leaped to over $197,000,000, an increase of 61 per cent. Between 1900 and 1910 the commercial ratings of the shoe manufacturers in the United States jumped from less than $61,000,000 to nearly $99,000,000, an increase of nearly 62 per cent. Between 1905 and 1910 the salaries and wages of all persons employed in shoe factories in the United States leaped from less than $78,000,000 to nearly $110,000,000, an increase of 41 per cent. Salaries alone increased 99 per cent, and wages alone increased 34 per cent. During the same period the number of salaried employees expanded from 8,811 to 14,513, an increase of 65 per cent; and the average number of wage earners increased from less than 150,000 to over 185,000, an increase of 23 per cent. From 1900 to 1905 the product of American shoe manufacturers increased from less than $259,000,000 to over $320,000,000, an increase of nearly 24 per cent. During the five years from 1905 to 1910 the output grew to nearly $443,000,000, a gain of 38 per cent. Between 1899 and 1910 the value of the exports of boots and shoes jumped from less than $2,000,000 to nearly $14,000,000, an increase of over 600 per cent. According to the last census this prosperity is shared by 50,000 independent retail shoe dealers and 1,343 separate shoe manufacturing establishments, all independent, who employ in the aggregate nearly 200,000 people and have an individual output of from 300 pairs to 25,000 pairs a day. "This industry," states the Massachusetts Commission on the Cost of Living, in its recent report, "is one of the few great lines of industrial enterprises in the United States in which the trust form of control has not made headway."

These figures all show that, possessed of the control of a valuable invention, the

To the Man with a Ventilating Problem

You remember what hot weather meant last summer — stifling rooms full of bad air, dulled brains, lagging hands, part of your office or factory unusable during the summer months.

You can stop all this at once and forever by installing the

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Ventilating Fans

Even where conditions are worst these fans will keep a room full of fresh pure air all summer, either forcing out the bad air or blowing in a steady, cool stream from outdoors.

The time to act is now, *before* hot weather comes.

Write us giving size and location of room, whether you wish to drive the fan by belt or electricity, and if by electricity what current you have—voltage, cycles, phase, etc.

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Booklet No. A-P-5 describes these Fans.

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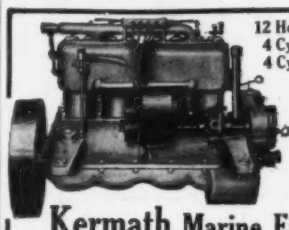

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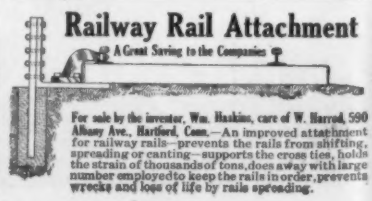

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Why Do Bearings and Gears Wear Out?

FIRST, let us analyze friction. Friction is the resistance or retarding force set up by two surfaces rubbing against one another. Each surface exerts an almost constant pull on the particles making up the other surface. The surface of the two which can the better withstand this frictional pull will be the surface to remain unworn. The bearing metal should be so designed as to give way before the steel. But the bearing metal should not give way to this pull too easily. That would mean quick bearing wear.

THE cohesive strength of the bearing metal should approach that of the steel as nearly as possible, just so it keeps under it. Such a metal is

HIGH SPEED NON-GRAN BEARING BRONZE

THE interlocked, cohesive, fibrous structure of NON-GRAN makes it almost impossible for the steel shaft to pull away the particles making up the surface which is presented to this pull. In NON-GRAN, the particles forming the bearing surface are all knit to, and therefore held down by the particles **beneath** the surface.

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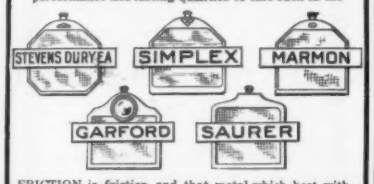

FRICTION is friction, and that metal which best withstands friction in motor duty, also best withstands friction in any other duty.

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Some Old Sewing Machine Patents

IN an interesting memorandum published in the consular and trade reports of the Department of Commerce, Dr. Darby of the Patent Office tells of the development of the sewing machine; how the earliest attempt at sewing by machinery of which there is any authentic record was in 1755, in which year a machine was patented in England by Charles F. Weisenthal, in which machine the stitch was formed by a needle having two points with an eye at mid-length, which passed completely through the goods in imitation of hand sewing.

Following this came an English patent dated July 17th, 1790, granted to Thomas Saint, for a machine that embodied several features employed in the modern sewing machine, namely, an overhanging arm, a horizontal cloth plate, a vertically reciprocating needle, and a feeding device. The needle, notched at its lower end, pushed a loop of thread through a hole previously made by an awl. The loop thus formed was held beneath the goods, and the next loop was passed through it, thus making what is known as the "chain stitch."

An Englishman named Duncan in 1804 made a chain-stitch machine that employed two hooked needles, and in 1830 a Frenchman named Barthelemy Thimonnier invented a machine which embodied the same principles with the exception that the loop of thread was pulled instead of pushed through the fabric.

The first American patent for a sewing machine was issued to a man named Lye in 1836. A fire, which occurred that year, destroyed all the Patent Office records, so that the construction of this machine is not known.

It is said that in the years 1832 to 1834 Walter Hunt of New York city built what was probably the first lock-stitch machine. This was provided with a curved needle (with an eye near the point) mounted on a vibrating arm. A loop was formed beneath the cloth by this thread-carrying needle, and a shuttle carrying an additional thread was passed through the loop thus formed, making a lock stitch. Hunt, however, did not apply for a patent until after the granting of the Howe patent, and his application was refused.

On February 21st, 1842, patent No. 2,466 was granted to John Greenough, which was the first United States patent for a sewing machine of which there is any existing record. This machine employed two needles, pulled entirely through the cloth by pincers, and the stitch was formed with two threads, the machine being used principally on leather work.

March 4th, 1843, patent No. 2,982 was granted to B. W. Bean; December 27th, 1843, patent No. 3,389 was issued to G. H. Corliss; and July 22nd, 1844, patent No. 3,672 was granted to J. Rodgers. In all of these machines a thread-carrying needle was pulled entirely through the cloth by pincers or clamps, forming what is known as a basting or running stitch.

Elias Howe patented his machine September 10th, 1846, patent No. 4,750.

The patent No. 6,439, granted to Bachelder May 8th, 1849, had a spiked, endless belt passed horizontally around two pulleys. This constituted the first practical continuous feed.

The Singer patent, No. 8,294, August 12th, 1851; the A. B. Wilson patent, No. 9,041, June 15th, 1852; and the Wilson patent, No. 12,116, December 19th, 1854, followed. The last named patent included a feed device comprising a horizontal bar furnished with a serrated surface, which bar was given an up-and-down motion in addition to a forward-and-back motion to feed the goods. This feed, known as the four-motion feed, is present in practically all modern domestic machines.

Dudley Avenue, Westfield, N. J.

A Tarvia Town

THERE are many towns in this country which began with Tarvia years ago and finding it successful have extended its use on their roadways year by year as a matter of fixed policy. Such a town is Westfield, N. J., which now has 19 miles of tarviated streets.

Mr. A. W. Vars, the town engineer, reports that the "Tarvia B" treatment on all these streets averaged 1¾c. per square yard for the season of 1912; compared with the cost of keeping down the dust and maintaining the road surface by any other method, this is a very low figure.

The roads have been free from dust and have not been seriously impaired by automobile traffic.

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Simply turn the Nozzle

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Whitehall Building New York City

At the present time sewing machines are divided into two classes, one including those for household or domestic use and the other special machines, such for instance as the McKay shoe sewing machines.

The Big Aeroplane and Transatlantic Flight

THE offer of a prize of $50,000 for a flight across the Atlantic Ocean in seventy-two hours, which was made recently by the *London Daily Mail*, has already brought forth about a dozen well-known constructors and pilots who are preparing machines for this flight.

Something over a year ago, we published in the SCIENTIFIC AMERICAN a very complete article on the transatlantic crossing by aeroplanes, together with a full-page illustration of a proposed biplane with five 50 horse-power Gnome motors by which Aviator-Mariner James V. Martin proposed to make the long flight. Recently a hydro-aeroplane has been constructed in England having three 50 horse-power Gnome motors arranged in somewhat the same manner as suggested by Mr. Martin, and having two floats in the shape of boats beneath the machine in each of which three passengers are carried. This machine, although only about half the size of the one designed by the American aviator, is built along the lines suggested by him. His idea was that after the machine was once in the air, one of the motors could be disconnected and the machine would run on the other four motors, or two hundred horse-power. As the fuel was used up and the machine became lighter, another motor could be cut out, and perhaps before the end of the voyage the machine would fly on but two motors, thereby making a great saving in fuel.

In order to cover the 1,800 miles from Newfoundland to Ireland, a speed of sixty miles an hour must be maintained for thirty hours. To maintain such a speed continuously on a machine large enough to carry sufficient fuel to make the flight without a stop, a motor of from 150 to 200 horse-power is necessary. A six-cylinder, water-cooled motor, such as is used on the German Zeppelin dirigibles, is the most economical and reliable motor for this purpose. Such a motor will consume only about one third of a pint of gasoline per horse-power hour, and very much less oil than will an air-cooled, revolving-cylinder motor like the Gnome. A 50-hour continuous run is nothing out of the ordinary for one of these airship motors; but in order to be absolutely certain of making the crossing, it would be well to have a second such motor in reserve.

The main point to be taken into consideration in the design of a transatlantic aeroplane is the reduction as far as possible of the head resistance. On this hangs the probability of crossing at the maximum speed and the minimum expenditure of fuel (that is, weight). As to the machine itself, this can hardly be constructed to weigh less than fifteen pounds to the horse-power. With fuel, powerful motors, men and supplies added, this weight may increase to as much as thirty or forty pounds per horse-power, which would mean a huge machine having 1,200 to 1,500 square feet of surface and weighing complete between three and four tons. At once the question will be asked, whether such a machine has ever been built and flown successfully.

The answer is, that some six months ago an aero-yacht biplane was constructed for M. Deutsch de la Meurth. This machine weighed complete with its live load over 6,000 pounds, and, propelled by a 200 horse-power motor, showed a speed of 68 miles an hour. Although a clumsy hull was fitted beneath the biplane, excellent speed was made with six or eight people. With the live load put into fuel, this machine would be capable of making perhaps one third of the distance across the Atlantic.

Another huge hydro-aeroplane that has recently been constructed, and that was sent to Monaco for the meet last month,

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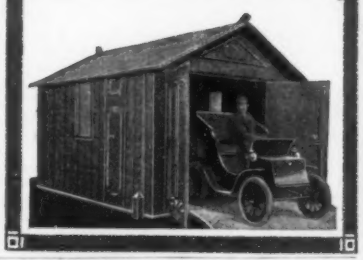

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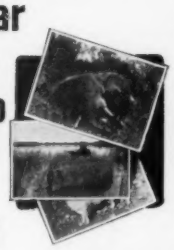

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is a huge following-surface biplane, consisting of two sets of biplanes mounted upon a single hydroplane hull, in which there are two 230 horse-power, six-cylinder motors geared by chains to drive a single propeller. This huge machine has a spread of nearly eighty feet and weighs empty 9,460 pounds. It is, therefore, comparable in size and weight to the Maxim machine which was built and flown in England in 1891, and which, had it been mounted upon floats and tried on the water as it was the intention of Mr. Maxim's chief helper, Henry A. House, to do, would have undoubtedly flown without mishap instead of being quickly smashed as it was when it ripped up the holding-down guard rail of the track upon which it was tried. This machine, by the way, had 363 horse-power, consisting of a steam engine and double propellers.

While neither of these two large hydro-aeroplanes just mentioned has been designed with the idea of cutting down the head resistance, there is no doubt that with all the experience obtained with dirigible balloons and aeroplanes having streamline bodies, it will be possible to design a machine having very much less head resistance than the usual weight-carrying biplane apparatus of the present day.

Obtaining Power from a Testing Plant

(Concluded from page 408.)

during the test for power purposes.

The tractors are belt connected to shunt-wound generators, running in parallel. This makes a very flexible outfit, as each engine load can be regulated by the rheostat of its generator and the load can be increased from small to full load as the engine warms up and works into the best condition. The fuel and water supply pipes run to each engine, making it an easy matter to keep the engine tanks filled. Each fuel pipe is provided with an individual meter. Suitable stacks are arranged for the exhaust gases, and easily adjusted blocks under the drivers hold the tractor in the belt.

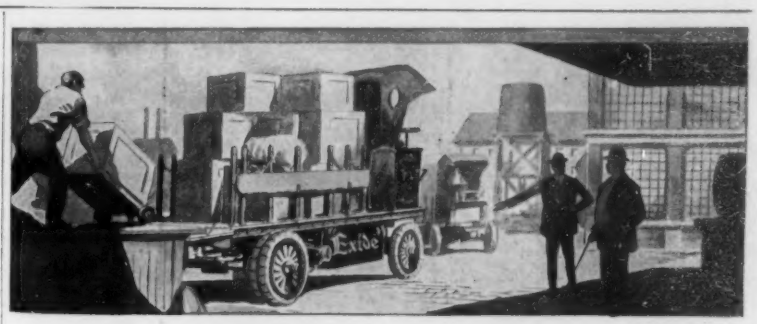
The changing of a tested tractor is a matter of five minutes. Fuel and water pipes are removed from tanks, blocks knocked loose and the stack raised. The tractor is then run ahead and the belt removed. The operations are reversed when running a newly constructed machine into belt.

The dynamos are shunt-wound, direct-current 250-volt machines. This type is used because it is automatic, to an extent, in regulation. If there is any trouble with an engine the shunt machine can motor, thus often saving the trouble of starting an engine because of dirty plugs or some minor trouble. Also in case it is desired to so do, the rheostat can be adjusted to carry a very small load. Further, engines of 30, 40, 60 and 80 horse-power are often being tested at one time. This condition would be quite difficult to handle with any other type of dynamo.

All wires are run under the floor in conduits from each machine to the back of switchboard.

A balance set is used, as the plant furnishes current for both light and power. The balance set is started by means of two switches and a rheostat, the field being permanently connected to the busbars. The balance set consists of two 30-kilowatt generators. The shafts are flexibly connected, and there has been no mechanical trouble whatever. The overload capacity is large, as a number of large motors have been constructed that run with 220-volt field and 110 to 220-volt armature current.

The power generated is used for running a machine shop, two foundries and various machines and lights about the plant. Two 20 and two 10-ton cranes, two 50 horse-power air compressors and large heating fan motors are some of the heavier motor loads. These machines and lights, of course, cause a great variation in the load, frequently varying it 100 per cent within a short time.



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LES ORAGES. Application des ondes hertziennes à leur observation. Julien Loisel, docteur-ès-sciences, météorologiste à l'observatoire de Juvisy. Préface par Camille Flammarion. Paris: G. Thomas, 1912. 8vo.; pp. vii, 120.

This is destined to be regarded as a standard work on thunderstorms; and as no such work exists in English, it is commended to the attention of American students and readers. The book is not difficult reading, as it involves but little mathematics, but on the other hand it is a serious treatise, not written to divert the multitude.

Thunderstorms are just now occupying the European mind to an unprecedented extent, mainly for two reasons: (1) Great efforts are being made in the Old World to avert or mitigate the destructive effects of hail, whether by "hail-shooting," "hail-rods," hail insurance, or protective measures contingent on timely warnings, and hail is the accompaniment of thunderstorms. In France alone hailstorms cost the country anywhere from $8,000,000 to $27,000,000 a year in ruined crops. (2) Thunderstorms constitute a grave danger to the aeronaut.

Dr. Loisel's book is a handy digest of the recent literature of his subject, fortified throughout with references to original sources of information, including many memoirs published in the scientific journals during 1911 and 1912. Thus we find the very latest attempts to explain the electrical field of the atmosphere, which take into account big and little ions, ultra-violet light, radioactive discharges from the sun and the earth, and the other novel agencies belonging to twentieth century electrical science. In the chapter on the electrification of clouds, the author presents not only the Wilson-Gerdien and Simpson hypotheses, but some objections to the latter put forth by J. Rey in a university thesis published in 1912, which has hardly yet found its way into the scientific libraries. The description of lightning phenomena might well have given more emphasis to the epoch-making researches of Walter, and might have been a little more positive as to the cause of "black" lightning, but is, on the whole, adequate. Here, as elsewhere in the book, we find a well-chosen collection of excellent photographs, lacking only the moving-camera pictures which Dr. Walter and others have made so familiar to the readers of the scientific journals, and which should certainly be included in any modern work on thunderstorms.

The relation of thunderstorms to the general barometric conditions is brought out in a chapter of text and charts. The author avoids giving too much prominence to the line-squall type of thunderstorm, with which M. Durand-Gréville's name is inseparably connected, and quotes the opinion of Angot that this type of storm is not so general as has been assumed in recent meteorological literature. A chapter is devoted to the question of predicting the movements of thunder storms from the ordinary weather map, and from the reports of a dense network of observing stations especially installed for this purpose; and points out how successfully such predictions have been made in Germany for the benefit of aeronauts. This subject leads up to a long final chapter on cerauographs, or thunderstorm recorders.

THE ROMANCE OF SUBMARINE ENGINEERING. Containing Interesting Descriptions in Non-technical Language of the Construction of Submarine Boats, the Salving of Great Ships, the Recovery of Sunken Treasures, the Building of Breakwaters, Docks, and Many Other Feats of Engineering Beneath the Surface of the Water. By T. W. Corbin. With 54 illustrations and diagrams. London: Seeley, Service & Co., Ltd., 1913.

The only serious omission that we can call attention to in this book is the failure to discuss the use of compressed air in the raising of sunken ships, a method that was used with conspicuous success in raising the "Barbarian" and other vessels. The book on the whole may be commended for presenting a very readable account of diving apparatus, submarine boats, caisson work, and submarine apparatus in general.

SAW FILING AND MANAGEMENT OF SAWS. By Robert Grimshaw. New York: Norman W. Henley Publishing Company, 1912. 16mo. Price, $1.

This is a book which is designed as a practical aid to those who use saws for any purpose. While, as its title implies, it treats principally of saw-filing, it also goes into the questions of gumming, spring-setting, and swaging.

WIRELESS TELEGRAPHY AND TELEPHONY SIMPLY EXPLAINED. A Practical Treatise by Alfred P. Morgan. New York: The Norman W. Henley Publishing Company, 1913. Price, $1.

This book embraces a complete and detailed explanation of the theory and practice of modern radio apparatus and its present-day applications, and contains a chapter on the possibilities of its future development. For those who wish an accurate, simply-worded book, suitable for a novice, Mr. Morgan's volume can be heartily recommended.

THE CINEMATOGRAPH AND NATURAL SCIENCE. By Leonard Donaldson. London: Danes, Ltd., 1912. 12mo. Price, 2s. 6d. net.

In this excellent handbook Mr. Donaldson has most interestingly revealed the part that the motion picture has played in science during the last few years. He has described for the benefit

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of the public, whose knowledge of motion photography is more or less limited to the amusement phase, an exposition of the scientific achievements of the cinematograph, coupled with various suggestions as to its possibilities of further utility in scientific research. He therefore discusses the motion picture as an educator, and shows how successfully motion pictures have been used in schools. That the motion picture is an aid to operative surgery is revealed in a chapter which includes, among other things, the views of Dr. Doyen, which have been rather widely quoted in medical periodicals. So, too, the author takes up the subject of the X-ray and the cinematograph. He shows the value of the moving picture in biological experiments and in photographing the pulsations of the heart, as well as in recording the flight of insects. A whole chapter is devoted to micro-cinematography and bacteriology. Interesting is his account of the manner in which natural phenomena are recorded on the moving film. How the motion picture has been used in astronomy, exploration, physiological botany, wireless telephony, aerial navigation, etc., is also taken up.

LE TEMPS QU'IL FAIT; LE TEMPS QU'IL FERA. Notions de météorologie à l'usage des aéronautes et des aviateurs. A. Berget. Paris: Librairie Ch. Delagrave, 1912. 8vo.; 261 pp.; illustrated.

For some years to come every new publication on the new science of aeronautical meteorology will inevitably be compared with the pioneer work in this field, Linke's "Aeronautische Meteorologie" (Frankfurt, 1911). Few books will not suffer by the comparison, and Dr. Berget's is not one of the few. Only the fact that the literature of this important subject is still meager, and that many aeronauts who are able to read French are, to their infinite disadvantage, unable to read German, makes it desirable to call attention in these columns to the first attempt on the part of a Frenchman to cover the subject in some detail.

The limits of aeronautical meteorology are not sharply defined, but Linke set a commendable example in confining his work very closely to matters of practical importance to the aeronaut, and not duplicating more than was necessary of the information found in ordinary works on meteorology. If Berget had followed the same plan his book would have been about one tenth its actual size. The aeronautical information is diluted to the last degree, though occasionally it is valuable, and even includes a few facts that Linke overlooked. Berget's meteorology is not always sound. The most remarkable blunder in his book is found on page 54, where it is stated that the isothermal layer is only three or four kilometers thick, and that the fall of temperature with increase of altitude (the vertical temperature gradient) is resumed above it. This statement bears eloquent testimony to the author's unfamiliarity with almost everything that has been written about upper-air meteorology (a whole library in itself) during the past eight years. The author also has faith in the efficacy of reforestation and inland seas to increase the rainfall, and in cannonading to avert hailstorms, doctrines that only the dilettante proclaims without, at least, a *pace* to the authorities. Why is "hail-shooting" mentioned at all in a work on aeronautical meteorology? Because, of course, aeronauts must be warned to keep out of range when this kind of bombardment is in progress! True, the hail-cannon discharges no projectile; but think of the "eddies"! The present reviewer diffidently suggests a comparison between the violence of these artificially-produced eddies "at an altitude of 400 to 500 meters" and that of the natural atmospheric billows and whirlpools which are negotiated with ease by every airman.

For readers already well grounded in meteorology there are some useful and suggestive things in Berget's book. On pages 19 to 26 there is a clear exposition of the relations between actual and relative velocity in the air, and of the limits imposed by the winds upon the actual dirigibility of "dirigibles." Elsewhere there is enough grain scattered through the chaff to render the book well worth reading. However, the amount of pertinent information omitted considerably exceeds what is included. Not to multiply examples, although whole chapters are devoted to various methods of weather forecasting, not a word is said about the special storm warning services for aeronauts which have grown up in Germany in the last few years, and are beginning to be imitated in other countries.

As the book is French it contains no index, of course. But, strange to say, neither does Linke's, which is German!

AN EXTENSION OF THE DEWEY DECIMAL SYSTEM OF CLASSIFICATION APPLIED TO THE ENGINEERING INDUSTRIES. By L. P. Breckenridge and G. A. Goodenough. Originally issued as Bulletin No. 9 of the Engineering Experiment Station in 1906.

The filing and classification of engineering data has become a matter of much importance, and this bulletin was prepared for use as a guide in carrying out such work. The original edition of Bulletin No. 9 was subject to the usual gratuitous distribution, and the subsequent demands were such that a second edition was printed and ultimately distributed. Altogether 20,000 copies were sent out. The demand having continued, it was finally decided again to revise and to print a limited edition. This has now been accomplished and the revised bulletin, much extended as compared with the original edition, is ready for distribution. It presents subdivisions of subjects in such detail as to constitute a complete classification for most engineering industries, even though they are highly specialized. The revision has been made in accordance with the 1911 edition of "Decimal Classification" by Melvil Dewey.

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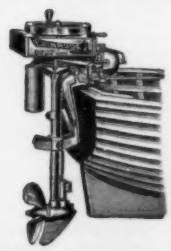

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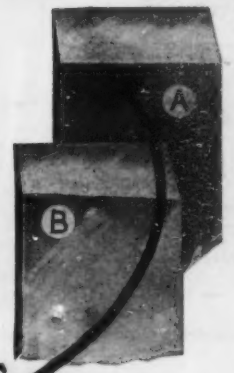

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"Inventor" and others are notified that although their questions are proper enough, they cannot be answered unless the name and address of the writer accompany the question. There will be no deviation from this rule.

(12788) G. M. asks: Can you tell me if you have any SUPPLEMENTS containing information of the construction of electrically operated, self-winding clocks, using dry batteries as the source of power? A. You will find in our SUPPLEMENT 153, 160, 198 and 962, price ten cents each, the descriptions of electrical clocks. The clock, patented under the name self-winding clock, is a regular clock movement with a spring which is wound by an electric motor every hour or half hour. 2. Can you tell me if the fused silicon which can be obtained from wholesale drug houses is suitable for use in making the silicon detector used in wireless telegraphy, and if not, will you kindly tell me where I can obtain same, and have you any SUPPLEMENTS on construction of said detector? A. The form of silicon used for a detector is a crystal, which is set in a holder and ground off on an oilstone till one side is flat and smooth. The making of the whole apparatus is described in Morgan's "Wireless Telegraph Apparatus for Amateurs," which we send for $1.50, and shall be glad to receive your order for a copy. The book gives sizes and all instructions for making the entire outfit, with engravings of all the parts.

(12789) L. L. L. asks: We are nickeling stove trimmings. What is the best analysis and best shape of anode to use? We are now using anodes ¼ inch thick, 6 inches wide and 19 inches deep. A. Nickel anodes should be of the purest nickel. The cast anodes are the softest, and will pass into the bath with greater ease than the rolled or those made by electricity. They have the disadvantage of becoming brittle before they are all consumed. The usual shape is a rectangle of about the proportions which you already have. The size depends upon the amount of surface of articles to be plated which you have in the bath at one time. The whole subject is fully discussed in Langbein's "Electro-Deposition of Metals," which we send for $5, and for which we shall be pleased to receive your order.

(12790) D. C. G. says: I have just observed something that may be a common phenomenon, but as it has never come under my observation before and I have never seen a note of it, am submitting it for what it may be worth. In front of our factory is a long railway siding on which much switching is done. By the side of the track, and distant perhaps eight or ten feet, is a line of poles carrying wires of one of the Niagara Falls power companies. These wires are about two feet apart, and carry 12,000 volts, 3-phase, 25-cycle current. Amperage of course I do not know. A few days ago a switching engine happened to pass along by the side of them, and as the mingled gas and steam rose through the wires, there appeared a peculiar flickering, like waves from wire to wire. It coincided with what I should judge to be the cycles of the current. It was not light, but gave the impression of waves. It was not present when there was clear steam, but only when the smoke and steam mingled rose through the wires. The day was bright, and the sun was shining clearly on the wires and smoke when it was apparent. This morning was a dark morning, with some mist in the air, and the same thing occurred, only more clearly, as the volume of smoke and steam was greater. I called our draftsman to note the effect, which we both saw clearly. A. The smoke, which consists of solid carbon particles and hot gases, would easily be charged by the wires and vibrate in sympathy with the cycles of the current. This may be what you saw as the smoke of the locomotive rose through the wires of the transmission line.

(12791) A. G. W. asks: We would thank you to give us the latest description and definition of radium; also what uses it is being put to and its intrinsic value. A. Radium is an elementary substance in the same sense as iron is an elementary substance. Many scientists believe that it is on the way to become some other substance, with different properties. It is not being put to any practical use unless by the physicians in the treatment of cancers, although here we cannot say that success is demonstrated as yet. We have published many articles upon radium, covering everything known concerning it. In addition to those in the catalogue which we send you, you will find a very valuable series by Prof. J. J. Thomson in SUPPLEMENT 1849, 1850, 1851. On the origin of radium, in SUPPLEMENT 1900; Radium in medicine, SUPPLEMENT 1858, and many others. We send these papers for ten cents each.

(12792) H. C. G. B. writes: Referring to the letter of Mr. Woods (SCIENTIFIC AMERICAN, Vol. 108, No. 13) as to the astronomical bull of placing Jupiter in Cassiopeia, I would say that it is not *two* famous men who made it, but only one, viz., Coleridge. Schiller says: "Der matte Scheindort, der einzelne, ist aus der Kassiopeia, und *dahin* steht der Jupiter." "Dahin" does not mean "therein," but "yonder." Cassiopeia is in one direction and Jupiter in another. The last editor who showed up Coleridge's blunder is Buchheim. (See his edition of "Wallenstein," Vol. II, p. 493.) A. You are quite right in your statement that the "astronomical bull" is that of Coleridge, and not of Schiller, in placing Jupiter in Cassiopeia. The simplest translation of "dahin" is "thither, in that direction," which would direct the attention in some other direction than toward Cassiopeia. It is then a wrong translation by Coleridge. Schiller was well versed in astronomical matters, and it would seem impossible for him to have made so false a statement. Jupiter at its nearest approach to Cassiopeia is about 55 degrees from Schedir, the brightest star of Cassiopeia. Among English poets Tennyson probably ranks highest for his strict adherence to the facts in his astronomical allusions.

(12793) P. B. S.: Can you tell me if there is a big field for chemists and electrical engineers, and if the remuneration for their (the average chemist and electrical engineer) services is sufficiently large to live well? If possible, could you tell me what the various positions these two fields cover, and what qualities a young man must have to be a successful chemist or electric engineer. I am a high-school graduate, have been in business over three years, but want to study a profession. The above-mentioned lines appeal to me, but I do not know much about them. A. Chemists and electrical engineers generally find work. We cannot say that it is always a "big field," nor that the salaries are always large. But "there is always room at the top," and if you make yourself a first-class man there will be no difficulty in getting something to do, by which you will be helpful in the doing of the world's work. The qualities which will bring success in these lines are the same as will bring success in any other line. They are a thorough mastery of the technique of your subject, willingness to take hold of the nearest thing and to do it faithfully and well. Chauncey Depew wisely said: "The young man who would rise in the world must never question the kind of work which is put upon him, the hours required of him, or the places, agreeable or disagreeable, to which he is assigned." Get ready for your work in the schools, and follow Mr. Depew's advice, and success will be yours. You will find seven engineering fields discussed in the SCIENTIFIC AMERICAN, Vol. 106, Nos. 9, 14, 18, 22; Vol. 107, Nos. 1, 5, 10. price ten cents each. Among these fields are the two which you mention.

(12794) U. F. L. asks: Can rubies be reconstructed? A. We presume that a ruby can be melted over and thus reconstructed, but as the natural ruby brings a much higher price than the artificial ruby, it is not probable that anyone would thus reconstruct a ruby. The artificial ruby is exactly like the natural ruby in its chemical constituents, color, hardness, etc.

(12795) E. K. D. asks: Is it possible, within attainable altitude, for any one ascending in a balloon to see the earth as a revolving globe? A. It is not possible, by going up in a balloon, to see the earth moving under you by its motion of rotation. The balloon will be borne along by the motion of the air with the earth in its rotation, so that the earth will only seem to move under the balloon as the wind blows the balloon along over the surface of the earth.

(12796) D. S. asks: 1. Is the ring around the sun the same as what is called the sun dog? And is this ring always the same distance from the sun when it appears? A. A "sun dog" is a portion of a halo or ring around the sun, usually the halo of 22 degrees, although halos of 45 degrees and 90 degrees also occur. There are many forms of the halo, the principal of which appear in a fully illustrated article in the SUPPLEMENT, No. 1924, price ten cents. The halo is formed in cirrus clouds which are composed of ice crystals high in the air, where the temperature is below the freezing point. 2. In what manner is the refraction of the sunlight performed to obtain the spectrum? How is ozone formed in the atmosphere when there has been no discharge of lightning? A. We have seen the statement in elementary chemistries that ozone is usually present in the air, but the higher textbooks do not justify this statement. We quote two. Alex. Smith's "General Inorganic Chemistry:" "It is very questionable whether there is any ozone in the air, excepting temporarily in the immediate neighborhood of a natural or artificial discharge of electricity." And Remsen's "College Chemistry:" "No satisfactory evidence of the occurrence of ozone in the air has ever been furnished." With two such doctors to support us we shall not attempt to account for ozone in air when there has been no discharge of electricity.

(12797) T. C. B. asks: Is there such a reptile as the hoop-snake? If so, has it the power to propel itself by grasping its tail in its mouth and rolling like a hoop? Has it a barblike point on its tail which it uses as a means of defense or offense? If such a reptile does not exist, whence comes the legend? A. The hoop-snake is a harmless species of snake abundant in the southern United States. It is a fable, says the Century Dictionary, that it can take its tail in its mouth and roll itself along like a hoop. We cannot say how the belief originated that it could do so. Nor do we know any snake in this country which can fight by striking with its tail after the manner of a scorpion.

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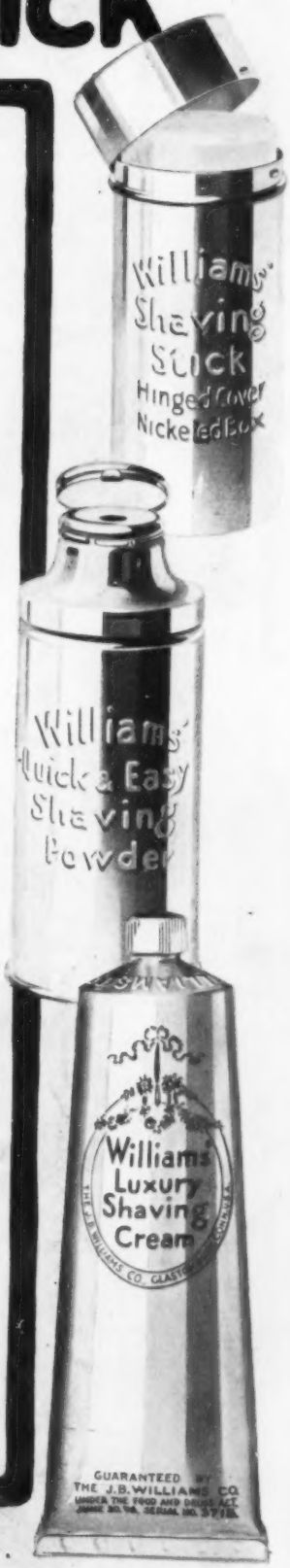
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